

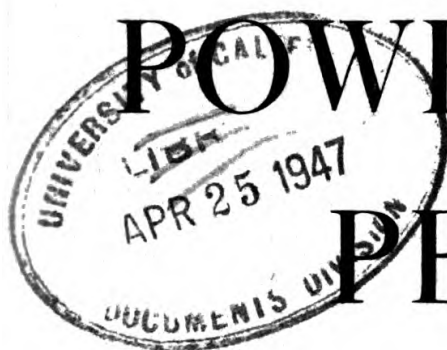
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WAR DEPARTMENT TECHNICAL MANUAL

U.S. Dept. of Army

POWER UNIT



PE-82-E

POWER UNIT
PE-82-E



WAR DEPARTMENT • 7 SEPTEMBER 1943

POWER UNIT PE-82-E

This technical manual published on orders 24671-Phila-43 and 500-Phila-44 and 7301-Phila-44 is furnished for the information and guidance of all concerned.

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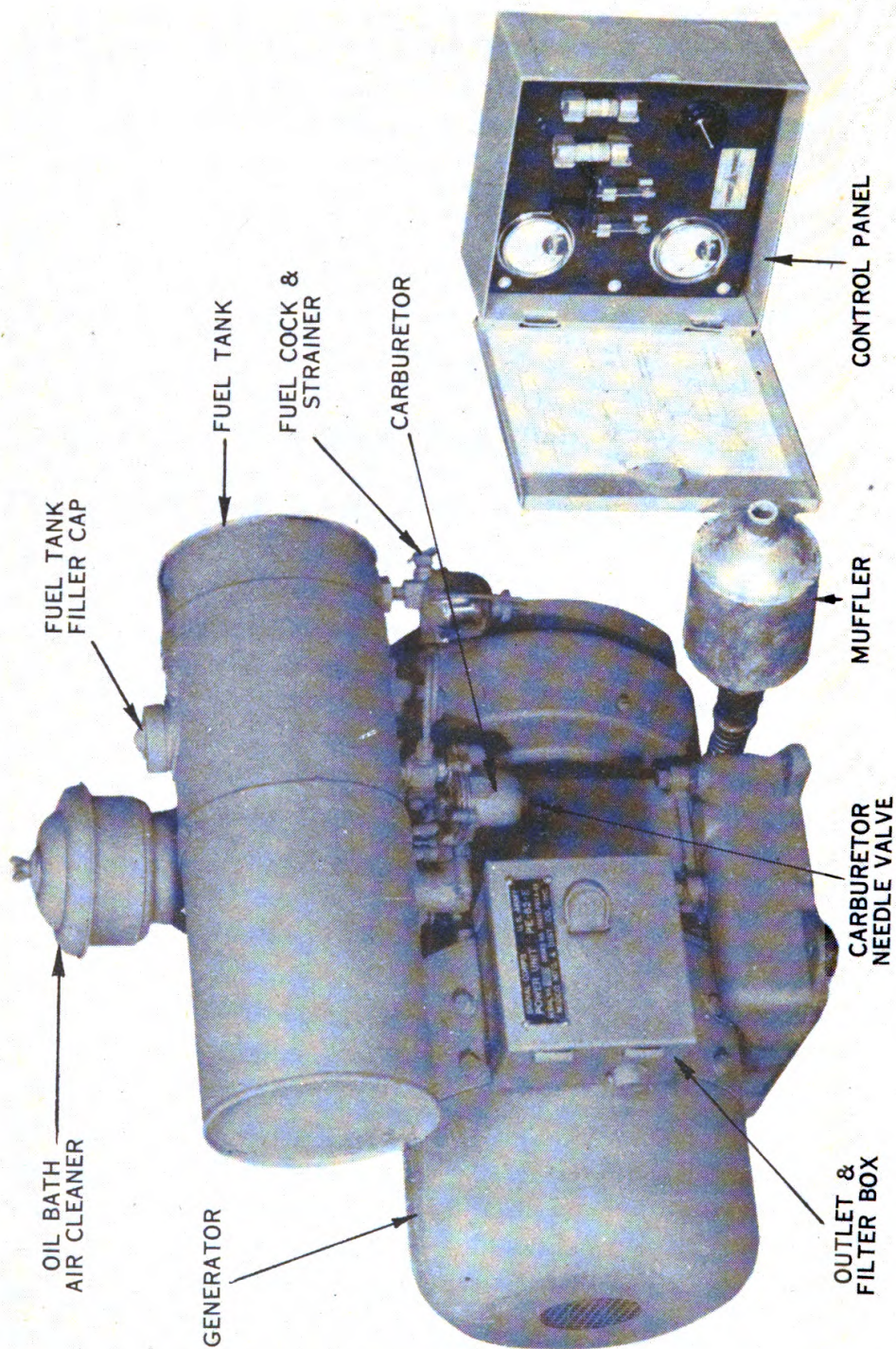


Figure 1—Power Unit PE-82-E, Intake Side

DESTRUCTION NOTICE

WHY—To prevent the enemy from using or salvaging this equipment for his benefit.

WHEN—When ordered by your commander, or when you are in immediate danger of capture.

HOW —1. Smash—Use sledges, axes, hand-axes, pick-axes, hammers, crowbars, heavy tools, etc.
2. Cut—Use axes, hand-axes, machete, etc.
3. Burn—Use gasoline, kerosene, oil, flame throwers, incendiary grenades, etc.
4. Explosives—Use firearms, grenades, TNT, etc.
5. Disposal—Bury in slit trenches, fox holes, other holes. Throw in streams. Scatter.
6. **USE ANYTHING IMMEDIATELY AVAILABLE FOR DESTRUCTION OF THIS EQUIPMENT.**

WHAT—1. Smash carburetor, flywheel, fuel tank, cylinder head and cylinder block; generator control panel, end of generator and generator frame.
2. Cut fuel tank, carburetion system and into end of generator in such a manner as to cut into armature windings, etc.
3. Burn fuel supply and generator.
4. Bury or scatter—Any or all of the above pieces after breaking.

DESTROY EVERYTHING

SAFETY NOTICE

This unit generates a voltage dangerous to life. At all times the operator must be careful to observe safety regulations. Connections should not be made while the unit is in operation. The control-panel cover should be closed after adjustment is made.

The exhaust gas generated as a result of combustion in the engine is a deadly poison not readily detected. The gas (CO) is called carbon monoxide, and is colorless and odorless. The exhaust gas shall be piped away from the operator to the outside of any housing for the power unit.

Do not refuel while the unit is in operation. Avoid spilling gasoline on a hot engine.

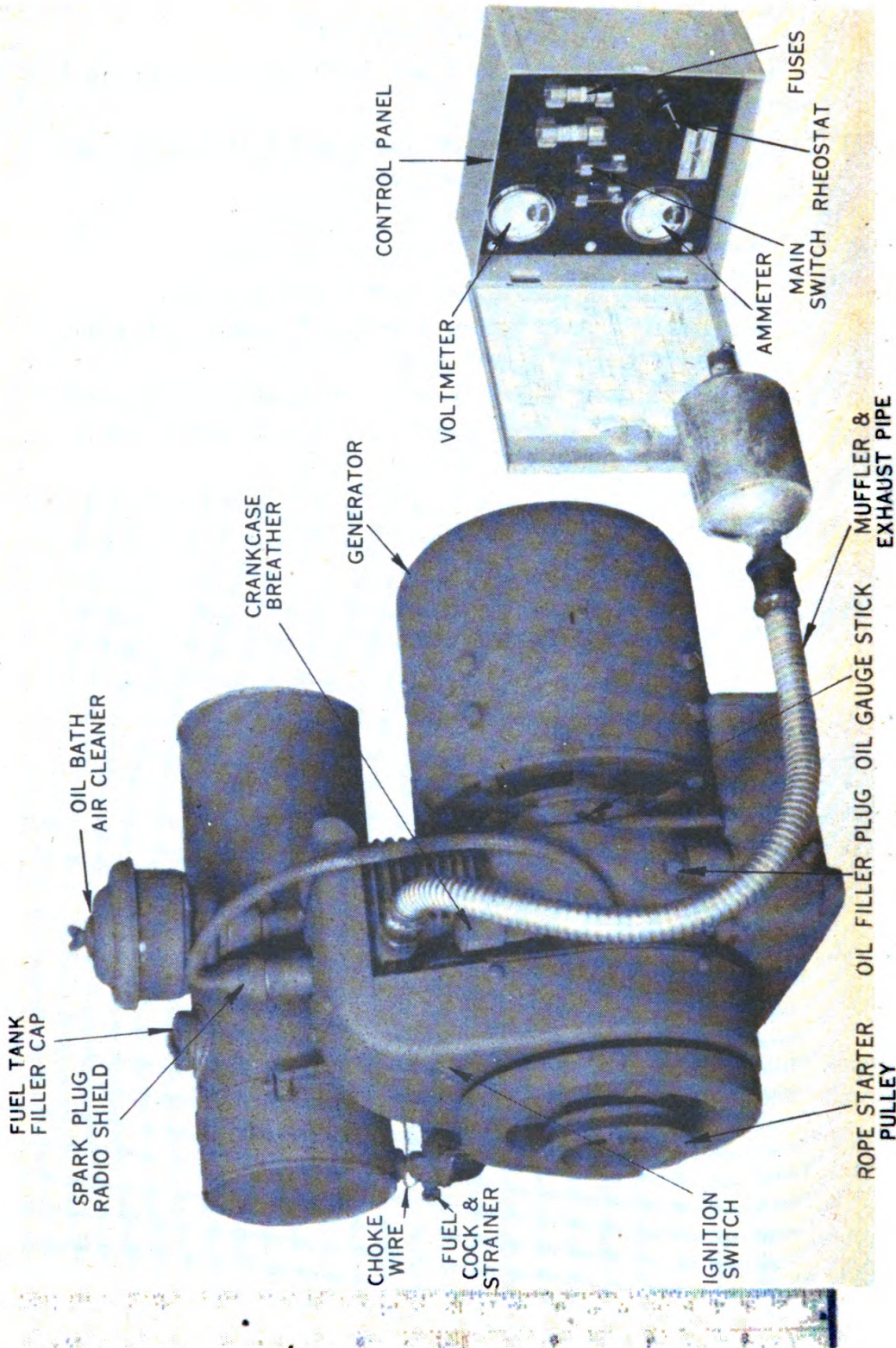


Figure 2—Power Unit PE-82-E, Exhaust Side

SECTION I

DESCRIPTION

1. **GENERAL.**—Power Unit PE-82-E is a self-contained electric-generating plant designed to supply continuously .5 KW, 110 Volt, single phase, 60 cycle A-C current at 80% power factor. The complete power unit PE-82-E as shipped comprises the following:

- 1 Power Unit PE-82-E Gasoline Engine Generator Set
- 1 Control Panel for Power Unit PE-82-E
- 1 Set of 4 Rubber Vibration Dampers for Generator Set
- 1 Exhaust Pipe and Silencer for Generator Set
- 1 Set of Spare Engine and Generator Parts:

- 2 Cylinder Head Gaskets
- 2 Bearing Plate Gaskets
- 2 Base Gaskets
- 2 Breather Gaskets
- 2 Inspection Plate Gaskets
- 2 Filler Plug Gaskets
- 2 Oil Pump Extension Gaskets
- 2 Carburetor Float Bowl Gaskets
- 4 Carburetor Inlet Seat Gaskets
- 2 Carburetor Main Nozzle Gaskets
- 2 Carburetor Main Screw Gland Gaskets
- 1 Spark Plug
- 1 Exhaust Valve
- 1 Magneto Breaker Point
- 1 Magneto Breaker Lever and Point
- 1 Magneto Condenser
- 1 Brush Holder Bracket Assembly
- 4 A. C. Brush and Spring Assembly
- 10 10 amp. Cartridge Fuses
- 4 D. C. Brushes

- 1 Set of Tools for the Maintenance of Power Unit PE-82-E:

- 1 Thin-wall Socket— $7/16''$ with $3/8''$ Sq. Handle Hole
- 1 Thin-wall Socket— $1/2''$ with $3/8''$ Sq. Handle Hole
- 1 Thin-wall Socket— $3/4''$ with $3/8''$ Sq. Handle Hole
- 1 6'' Square Handle for above sockets
- 1 Spark Plug Socket and Handle— $13/16''$
- 1 Screw Driver, shock-proof, handle—6''

- 1 6" Thin-nose Plier
- 1 Feeler Gauge—.008 and .020"
- 1 Breaker Point File

The dimensions and net weights of the equipment are as follows:

	Height	Length	Width	Weight
Power Unit only	22"	20 $\frac{3}{4}$ "	15 $\frac{3}{4}$ "	139 $\frac{1}{2}$ lbs.
Control Panel	8 $\frac{1}{2}$ "	8 $\frac{1}{2}$ "	4 $\frac{1}{2}$ "	3 lbs.
Exhaust Tube & Muffler		33"	3 $\frac{1}{2}$ "	2 $\frac{1}{2}$ lbs.

Power Unit PE-82-E consists of a self-excited generator directly connected with and attached to a single-cylinder gasoline engine operating at 1800 r.p.m. A separate box-type control panel suitable for mounting on a wall is provided. Four rubber shock absorbers are supplied for vibration damping and are placed between the engine base and the mounting block. The control panel contains a fused switch and rheostat, together with a voltmeter and ammeter. The engine is equipped with a flexible exhaust pipe, to the end of which the exhaust silencer is attached. The engine is a four-cycle, single-cylinder, vertical, air-cooled type with high-tension magneto ignition. It has a fuel capacity of 2 gallons, and an oil capacity of 2 quarts. The fuel consumption is 2 gallons for six hours of operation.

2. ENGINE SPECIFICATIONS

4 Cycle	L-Head Vertical, Single Cylinder
Cylinder	Close-grained Grey Cast Iron
Crankshaft	Counterbalanced Steel Forging, Heat-Treated
Connecting Rod	Aluminum Alloy, I-Beam Section
Piston	Aluminum Alloy, Heat-Treated
Piston Pin	Steel Hardened and Ground
Cam	Steel, Machined, Hardened and Ground
Valves	Steel, Mechanically Operated
Valve Seat Inserts	Nickel-Chrome-Molybdenum Iron
Governor	Flyball Type with Speed Regulator
Ignition	High-tension Flywheel-Type Magneto

Carburetor.....	Automotive-Type Float-Feed
Lubrication.....	Splash System with Oil Pump
Head.....	Cast Iron
Main Bearings.....	Anti-Friction Ball Bearings
Air Cleaner.....	Oil-Bath Type
Bore.....	2 $\frac{1}{4}$ "
Stroke.....	2 $\frac{1}{4}$ "
Piston Displacement.....	8.94 Cu. In.
Compression Ratio.....	6 to 1
Connecting Rod Bearing.....	$\frac{7}{8}$ " x $\frac{7}{8}$ "
Diameter of Wrist Pin.....	$\frac{9}{16}$ "
Diameter of Valves.....	1"
Number of Compression Rings.....	2
Number of Oil Rings.....	1
Width of Compression Rings.....	$\frac{1}{8}$ "
Width of Oil Rings.....	$\frac{5}{32}$ "
Length of Connecting Rod.....	4 $\frac{1}{2}$ "
Size of Power Takeoff Shaft.....	$\frac{3}{4}$ "
Spark Plug Size.....	14 mm.
Rotation of Takeoff Shaft.....	Counter-Clockwise Facing Shaft
Fuel Tank Capacity.....	2 Gallons
Oil Capacity.....	2 Quarts
RPM.....	1800

3. GENERATOR SPECIFICATIONS.—

a. Voltage at full load—110.

Capacity at rated load—.5 kw, 80% power factor or
.625 kva at unity power factor.

Continuous operation with 40° Centigrade temperature
rise.

Regulation 10% from full load to 25% load.

Rheostat provided for closer voltage regulation at
varying loads.

Type of generator, self-excited single phase.

- b. **Construction**—Steel with laminated steel pole shoes bolted in place.

Armature—Laminated steel core, pressed and locked on steel shaft sleeve.

Commutator—Drawn copper bars, separated by undercut mica insulation.

A. C. Collector Rings—Bronze rings mounted on insulated base.

Brush Bracket—Phenolic sheet with brush holders and mounting brackets riveted in place.

Brushes—4 d-c of high-grade carbon mounted in automotive-type holders; 2 a-c. mounted in cartridge-type holders.

Windings—Field coils machine-wound for uniformity, amply insulated with tape and insulating varnish. Armature impregnated with insulating compound and baked.

Cooling—Large steel fan mounted on outboard end of armature providing air flow through entire generator.

Control Panel—Enclosed in metal box with hinged cover. Panel contains a-c. voltmeter and ammeter, line knife switch, fuses, and rheostat for voltage regulation.

Filter—R-F (radio frequency) filter chokes and condensers mounted in outlet box on generator frame. D. C. brush filters mounted on brush bracket.

REMEMBER THESE POINTS

1. Don't attempt repairs or adjustments to this unit unless you are sure what you're doing.
2. Watch your lubrication; check the oil level every 5 hours.
3. Don't take chances with carbon monoxide; keep your exhaust line gas tight and be sure you have proper ventilation.
4. Be sure there is no dirt in your oil and gasoline.
5. Keep your air filter clean. Watch this closely in dusty locations.
6. Keep the unit as clean as possible. Dirt on the cooling fins and in the air passages will cause overheating.
7. Don't expose your unit to rain or dampness. Electrical equipment and water don't mix.
8. Look out for shock. Don't touch exposed wires.
9. Go over your unit daily and tighten all screws and nuts.
10. Don't spill gas on your unit when filling the tank. It may catch fire.
11. Always warm up your unit before applying a load.
12. Study this book. Keep it handy. It'll save you plenty of headaches.

SECTION II

INSTALLATION AND OPERATION

4. **INSTALLATION.**—**a.** As soon as the packing crate has been removed, the unit should be carefully examined to determine whether or not any damage has occurred in shipment. If so, report this fact immediately in order to obtain replacement parts.

b. Four rubber vibration dampers are furnished. Place these dampers (flat side up) over each of the four studs or bolts used to fasten the power unit in place. Lower the power unit in place over the dampers and secure with stud or bolt nuts.

In preparing the generator for operation, mount the control panel box on a wall or bracket close to the unit and connect it to the outlet box on the side of the generator through a four-conductor BX cable or steel conduit. The wires at the generator outlet box and at the control panel are clearly marked and must be connected through the numbered wires of the cable, so that like wires of the same number are connected together. Run the exhaust pipe to the outside of the building housing the power unit. Use a $\frac{3}{4}$ " pipe for distances up to four feet and $1\frac{1}{2}$ " size pipe for longer distances. Reduce the size of the exhaust pipe to $\frac{5}{8}$ " at the engine. Avoid sharp bends which will create a back pressure in the exhaust system of the engine. Do not enclose the power unit in a close-fitting housing unless panels are provided which can be opened to allow a free flow of air through the power unit blower housing to cool the unit.

5. **PREPARATION FOR USE.**—**a.** To prepare the engine for use, fill the crankcase up to the F. mark on the Bayonet Oil Gauge with a high-grade oil through the oil-filler plug at the base of the engine. (Use SAE No. 30 in summer and SAE No. 20 in winter. If SAE No. 20 is not available, use SAE No. 10 in cold temperatures. A heavier oil must not be used.) At the same time pour a small amount of oil (the same grade used in crankcase) into the oil-bath air cleaner at the top of the engine. Fill to oil-level mark located near the bottom of the cleaner housing. **An engine run without oil**

will be ruined within a few minutes. To avoid such a possibility, fill the crankcase at the oil-filler plug after every five hours of running. Drain the oil after 30 hours of running and refill with new oil. Do not flush the engine, as some of the flushing agent will be trapped in the pockets inside of the crankcase, and when new oil is added, will dilute the oil. Draining the oil while the engine is warm will accomplish all that flushing can do toward removing any sediment in the bottom of the crankcase.

b. Fill the fuel tank with gasoline. (Capacity 2 gallons) Use only clean gasoline from a clean container, and be sure that the funnel used in filling the tank is clean. The use of high-test gasoline will decrease the carbon deposits and prolong the life of the engine.

CAUTION: DO NOT MIX OIL WITH FUEL IN GASOLINE TANK.

6. OPERATION.—a. Open the fuel stop-cock located at the fuel filter sediment bulb. Snap the ignition switch to ON position. This switch is located on the side of the flywheel housing. Pull out the choke wire, located at the flywheel end of the fuel tank. Wind the starter rope around the starter pulley and give it a quick pull. If the unit starts, release the choke wire. If it does not start, rewind the starter rope on the starter pulley, as before and pull quickly without pulling out the choke wire. Should the engine fail to start after several attempts, repeat the choking operation. The needle valve on the carburetor has been preset and should not require adjustment unless it has been tampered with. If the engine fails to start after a reasonable number of trials, refer to Trouble Chart, paragraph 13. Do not attempt to make any adjustments until you have thoroughly read this instruction book.

CAUTION:—NEVER RUN THE ENGINE CONTINUOUSLY WITH THE CHOKE PARTIALLY CLOSED.*

* When the choke wire is pulled out, the gasoline has less air mixed with it than normally. In this position, the choke is said to be closed. When in all the way, it is said to be open.

Note: After the engine has been allowed a few minutes to warm up, the load may be applied to the generator circuit by closing the line switch located at the control panel.

b. To obtain the exact voltage, after the load has been applied, the rheostat located on the control panel should be turned clockwise (to the right) to increase the voltage and counter-clockwise (to the left) to decrease voltage until the desired voltage is obtained. The generator will not be injured if operated with no load applied to it.

Note: The rated load of the power unit is .5 kw (kilowatt) at 80% power factor at the rated voltage of 110. **Do not attempt to apply equipment which consumes more power than the rated power of the generator.**

c. **How to Adjust Carburetor.**—(See Figure 3). The carburetor has two adjustments, one for full load and one for idling. To adjust for full load, turn the lower needle valve in, or to the right as far as it will go. Be careful not to force the needle against the seat. Then open the needle by turning to the left one turn and start the engine. After the engine is warmed up and running with the choke wide open, on full load, turn the needle valve to the right until the best running condition is obtained.

The Idle Adjustment screw is located on the top of the carburetor and is slotted for screw driver and locked with a brass jam nut. Loosen the jam nut and turn the screw until it is just seated. Do not turn in too tightly. To adjust, turn out approximately one turn and lock with jam nut. Engine must idle smoothly while running without load. Final adjustment should be made while engine is running.

d. The speed of the power unit has been preset at the factory, to 1800 rpm. The speed is regulated by the governor speed adjusting lever, located on the carburetor side of the engine. If further adjustment is made necessary, refer to Section IV, paragraph 10-u.

e. To stop engine, snap ignition switch to OFF position.

SECTION III

FUNCTIONING OF PARTS

7. THEORY OF THE FOUR-CYCLE ENGINE.—

The engine of Power Unit PE-82-E is of the four-cycle, internal-combustion type. The four-cycle engine requires four strokes of the piston (two full revolutions of the crankshaft) to complete all the operations that comprise one complete cycle. The various strokes of one complete cycle are as follows:

Intake: The piston is traveling down with intake valve open. The vacuum created by the down stroke of the piston draws a charge of combustible mixture into the combustion chamber. The intake valve closes at the bottom of this intake stroke.

Compression: In the second stroke of this cycle both intake and exhaust valves are closed, and the piston is traveling up. This compresses the combustible mixture previously drawn into the combustion chamber.

Power: The third stroke of the cycle is the power stroke. During this stroke both valves are closed. At the beginning of the stroke the fuel charge is ignited by means of a high-tension electric spark introduced into the combustion chamber through the spark plug, and timed to occur at the proper moment of compression. The subsequent expansion of gases furnishes the motive impulse to the piston, driving it down on the power stroke.

Exhaust: The exhaust valve opens at, or near, the end of the power stroke, and the upward travel of the piston on the fourth, or exhaust stroke drives the gases of combustion out of the cylinder. The intake valve opens at the top of this stroke and another cycle is begun.

In the above-described four-stroke cycle, the valves are actuated by means of a cam and cam shaft geared directly to the engine crankshaft.

8. THEORY OF THE ELECTRIC GENERATION.—

The generator supplied on Power Unit PE-82-E is composed of two principal parts, the field assembly and the armature.

It is known that when a copper wire passes through a magnetic field, an electric current is produced. Thus, when the armature is made to revolve in the magnetic field of the generator (of low intensity when not energized), a small amount of electric current is produced in the revolving coils of the armature and passes from the commutator by means of the brushes to the field coils, thereby energizing them and increasing the magnetic flux of the field. This is called building up the field. This builds up to a certain point which is regulated by the speed of the armature and the construction of the machine.

The field assembly consists of four electro-magnetic poles mounted internally on the frame of the generator. The poles are encircled by field coils, which energize the magnetic flux of the field.

The armature consists of a number of coils wound on a steel core, so as to revolve in the magnetic field of the generator, thus cutting the existing lines of force (produced by the field poles). One set of these coils are connected to commutator bars or segments. A set of carbon brushes are mounted to contact the commutator, picking up electric current as it is produced. The commutator is arranged so that current picked up will flow in one direction only (uni-directional). This is called pulsating direct current. The brushes are connected to the field coils so that current picked up by them passes through the coils, energizing them.

A second set of coils are wound on the armature with the ends terminating on a pair of collector or slip rings, contacted by a set of brushes. These brushes pick up the alternating current which is connected to the load of the generator.

It will be noted that the generator is actually two generators in one.

(1) A direct-current generator whose armature coil ends are contacted by the brushes in such a manner that current will flow only in one direction and is available to the field coils to energize the field poles. This is called a shunt-wound direct-current generator;

(2) An alternating-current generator whose armature coils are connected to the collector rings in such a manner as to produce a current that changes its direction of flow in a 60-cycle unit in direct proportion to the speed at which the armature is revolving. In a 60-cycle unit, this takes place 60 times a second.

The complete generator is called a self-excited, alternating-current generator.

In order to regulate the voltage of the generator, a rheostat, or variable resistance, is introduced in the field circuit (See Figure 8), which varies the intensity of the magnetic flux of the field, thereby varying the voltage induced in the armature. This rheostat is operated by a knob, located on the control panel.

The radio-frequency-noise-filter system, part of which is located in the outlet box on the side of the generator, consists of an r-f choke in series with each of the a-c leads, the input and output sides of these chokes being bypassed to ground through condensers. Within the generator housing a .5 mfd. condenser is connected from the positive brush to ground and also from the negative brush to ground.

The engine ignition system is completely enclosed in a metal shield properly grounded at both ends.

SECTION IV

MAINTENANCE

9. ENGINE PRECAUTIONS.—a. After every five (5) hours of running and / or before restarting Power Unit PE-82-E, check the oil bayonet-gauge located on the exhaust side of the engine. Add oil up to the F mark on the oil stick. Add oil every five hours and change oil every 30 hours of running.

b. Check the fuel supply. If the unit is used in dusty location, clean out the gasoline strainer bowl under the fuel tank weekly.

c. Check the oil-bath air cleaner on the top of the air-cleaner pipe weekly. In dusty or dirty locations, clean the filter daily in clean gasoline. Shake out all excess gasoline after cleaning. Refill bowl with clean oil to level mark on the side of the bowl. When replacing, be sure the air-cleaner gasket is in place.

d. Occasionally remove the crankcase-breather assembly located on the cylinder block under the exhaust port, and wash in clean gasoline. This should be done about once a month. Shake out excess gasoline before replacing. Be sure the gasket is in place when replacing the breather.

e. In restarting the unit, see that the gasoline shut-off located on fuel strainer is open; snap ignition switch located on the blower housing to ON; close choke by pulling wire loop located under fuel tank; wind rope around starter pulley and give a quick pull to start engine. After the engine is started, release choke and allow engine to attain running heat before applying load.

10. ENGINE MAINTENANCE.—a. Proper maintenance of this engine will add greatly to its life and performance. Check oil frequently (every 5 hours) and keep to the proper level.

Remove carbon at regular intervals. Use the best grade gasoline, possible. Keep the spark plug gap at .020" to .025".

TABLE OF ALLOWABLE CLEARANCES

Wearing Parts	Normal or Minimum Clearance when new	Clearance when adjustment or replacement is necessary
Magneto Breaker Points.....	.020	.025
Spark Plug Gap.....	.020	.025
Piston Pin Bearing.....	.0002	.0015
Crank Pin Bearing.....	.001	.004
Piston.....	.0045	.009
Piston Ring Gap.....	.010	.045
Valve Stem.....	.002	.010
Valve Lifter.....	.008	.015
Rocker Lever Stud.....	.001	.005
Camshaft.....	.001	.005

b. How to Adjust Carburetor.—(See Figure 3). This carburetor has two adjustments, one for full load and one for idling. To adjust for full load, turn the lower needle valve in, or to the right as far as it will go, being careful not to force the needle against the seat. Then open the needle by turning to the left one turn and start the engine. After the engine is warmed up and running with the choke wide open, on full load, turn the needle valve to the right until the best running condition is obtained.

The Idle Adjustment Screw is located on the top of the carburetor and is slotted for screw driver and locked with a brass jam nut. Loosen the jam nut and turn the screw until it is just seated. Do not turn in too tightly. To adjust, turn out approximately one turn and lock with jam nut. Engine must idle smoothly while running without load. Final adjustment should be made while engine is running.

c. How to Remove and Repair Carburetor.—Close shut-off valve on gasoline-filter. To remove the carburetor, remove the fuel line from carburetor. Remove screws holding fuel bowl to throttle body. Disconnect throttle link, unscrew throttle body from cylinder.

The repairs most generally needed on the carburetor are due to a worn throttle shaft, leaky or dented float or a worn gasoline inlet needle and seat assembly.

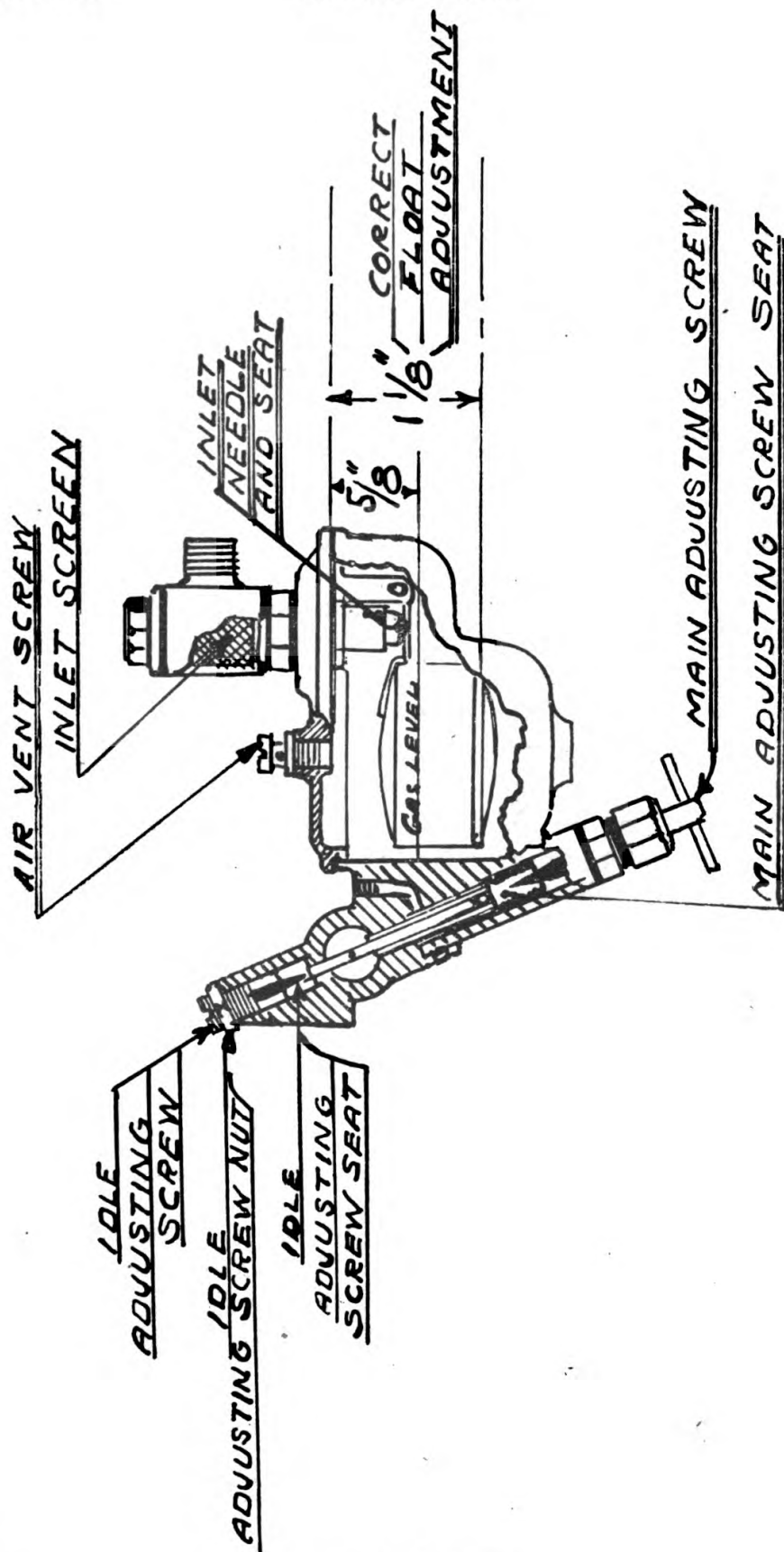


Figure 3—Carburetor

To repair throttle shaft, remove screw holding the throttle shutter, remove the shaft and replace with new one.

CAUTION: Be sure when replacing throttle shutter that it does not bind or stick to the sides of the body. This can be prevented by placing a thin sheet of paper between the body and the shutter. This shaft must work freely to obtain good governor action.

To repair needle and seat, replace with a new assembly. This needle and seat cannot be serviced separately. Be sure when re-assembling the complete carburetor, that the gasket is put on correctly. Do not forget the fuel float.

d. To Clean Carburetor.—Close fuel line shut-off valve. Remove screws holding fuel bowl and clean out bowl. Remove needle valve assembly. Be sure that fuel jet is open. (Never screw needle valve too tightly against seat.)

e. How to Test Magneto.—Before starting the engine, remove nut holding the spark plug wire to plug. Start the engine and when it has obtained its proper operating speed, carefully remove the spark plug wire from the plug. Be sure to take hold of the wire about two inches from the terminal end, and hold about one-quarter inch from the end of the plug. This must be done quickly or the engine will stop. If a hot blue spark occurs, the magneto is in good condition. If the engine misses fire or stops, the magneto is weak, or you have held the wire too far from the plug. A weak condenser, faulty coil or improper breaker point spacing, are the most probable causes of magneto failure.

Spark can also be checked by holding spark plug wire $\frac{1}{8}$ " from the spark-plug base or by removing the spark plug, placing its shell on the cylinder head and giving the engine a quick turn, the magneto is in good condition if a spark occurs at the spark gap of the spark plug.

f. How to adjust and repair magneto.—Remove the starter pulley, outboard flywheel, blower housing and magneto flywheel in the above order. Remove stud nuts and slip the starter pulley off its studs. Next take off the outboard flywheel.

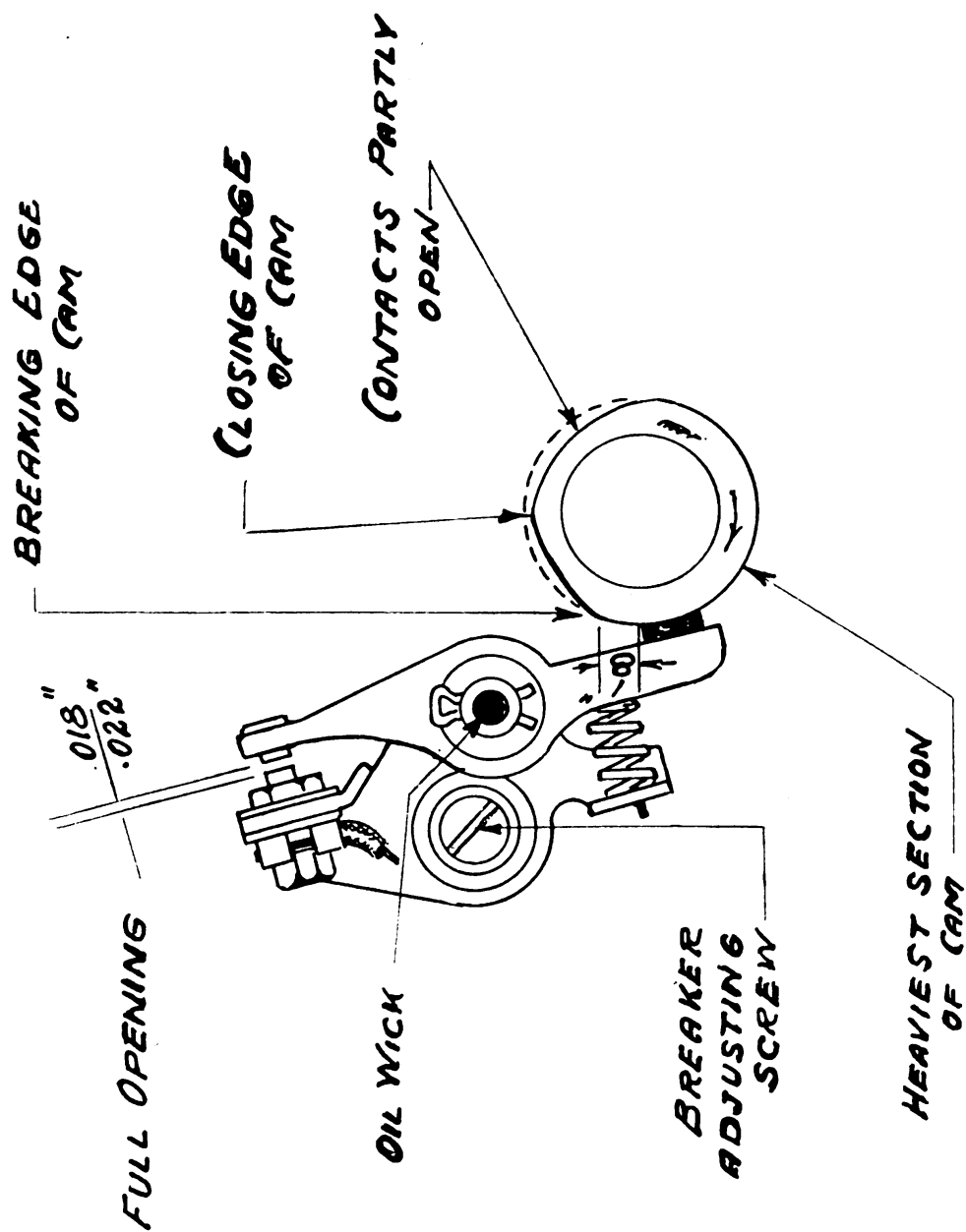


Figure 4—Breaker Assembly

Remove the blower housing screws and the blower housing. Loosen the crankshaft nut a few turns, strike it (squarely) a sharp blow to jar the magneto flywheel loose from its taper. Remove the nut and flywheel. The breaker points are easily accessible after the flywheel is removed. The contact points should be clean and touch squarely. If either is pitted, a small ignition point file should be used to file them, so that they meet evenly. To adjust the points, turn the crankshaft until the breaker arm rests on the highest point of the cam. (See Figure 4). The correct gap between the contact points should be twenty thousandths of an inch (.020"). Loosen the breaker plate screw and move breaker plate in either direction to obtain correct gap.

When reassembling stator plate on rear bearing plate, make certain that the mark on the stator plate coincides with the arrow on the bearing plate.

If a new stator plate is installed which has no timing mark, timing is done as follows:

Place piston $\frac{1}{4}$ " before top dead center on the compression stroke, ie., when both valves are closed and the piston is on the up stroke. Then move the stator plate until the breaker points just open. (Simplest method to determine when points are just opening is by placing a piece of cellophane between the points, exerting a slight pull on it while turning the stator plate. When the piece of cellophane slips free the points are just opening.) When that point is reached, lock the stator plate securely with bolts provided and mark stator plate to coincide with the arrow on the bearing plate for future ease in adjustment.

CAUTION: Always be sure that contact breaker plate screw is tightened before re-assembling the flywheel.

g. To Change the Condenser.—To change the condenser, (Ref. Par. 10f) remove primary wire leading to breaker point bracket, remove screw holding condenser to back plate. When replacing condenser, be sure to include grounding wire leading to coil.

h. To Change Coil.—Remove stator plate from engine. (Ref. Par. 10f) Disconnect the secondary or spark-plug wire from the coil before removing. Before pulling coil from the pole-shoe assembly, bend the laminated clip holding coil in place.

i. Spark Plug Adjustment.—Spark plugs should be cleaned about every 100 hours, and the points reset to twenty-thousandths inch (.020"). Points burn away in service. The porcelain is to prevent the spark from jumping anywhere except at the gap, and if cracked, broken, or dirty it will prevent the plug from firing. Water or moisture on the outside of the spark plug may permit the high-voltage current to leak or jump over the surface of the open part of the porcelain. Dirt or carbon on it will do the same thing.

j. When Spark Plug Fouls Frequently.—Frequent fouling of spark plugs is caused by too rich a mixture from the carburetor (too much gas; not enough air). It may be caused also by the cylinder pumping oil, due to worn piston rings, bent connecting rod, breaker not functioning properly, clogged muffler, too much or too light oil, or too long an exhaust pipe.

k. Ignition Cable.—The insulation must not be broken or soaked with oil or water, or grounded in any way where it touches the engine, or it will interfere with proper ignition.

l. Oil Pump.—The oil pump in this engine is of the plunger type, operated by means of an arm riding on the valve-operating cam. The oil is pumped up from the engine base into a splash tray, which is in line with the connecting-rod dipper. By this means oil is distributed to all the internal moving parts.

m. To Repair Oil Pump.—Drain oil from engine base. Separate the cylinder from the engine base.

Pump failure may be traced to several causes, such as a worn pump plunger, or sediment under the check ball. If any of the parts are worn, it is best to replace the entire pump assembly.

Test the oil pump before joining to base by placing suction end in oil and operating pump arm with about one-quarter inch ($\frac{1}{4}$ ") movement.

When reassembling the engine, be sure that the pump-arm roller rides on the valve-operating cam, next to cam-shaft boss.

n. Compression.—Proper compression is obtained when valves seat properly; cylinder-head gasket and spark-plug gasket do not leak; and piston and piston rings are properly fitted. To check compression, turn engine over quickly, and if a point of good resistance is met at every other revolution, compression should be satisfactory. If the engine turns without compression resistance, a worn piston, piston rings or cylinder wall; leaky valves, leaky gaskets, or loose or damaged spark plug are indicated. Check cylinder-head gasket and see that cylinder-head nuts are drawn up tightly. Check spark-plug gasket and see that plug is drawn up tightly.

o. Carbon in Cylinder.—Excessive carbon in cylinder is caused by running the engine with needle valve on carburetor opened too far, or worn cylinders, pistons, or rings. Carbon will cause pre-ignition and a noise similar to pounding, called pinging. In such a condition the head should be removed, and the carbon scraped from the cylinder head and top of piston. In the burning of high-octane fuel, the carbon deposit accumulates much faster and, therefore, carbon removal should be done more often.

p. To Remove Cylinder Head.—Remove nuts holding head in place, and raise head off head studs. After cleaning carbon out of combustion chamber, care should be exercised in replacing cylinder head. Use a new gasket, if possible; otherwise clean old one thoroughly. *Do not use shellac on cylinder head gaskets.* Tighten each cylinder head nut a little at a time, so that cylinder head is pulled down evenly. Retighten after engine is warmed up.

It is advisable to check the valve seats while the head is off. Squirt a little flushing oil under the valves and turn valves several times when down on seat. This will clean off any particles of carbon and tighten up the seats.

q. How to Remove Piston.—To remove the piston it is necessary to remove the cylinder head, separate the base from the cylinder, and disconnect the connecting rod. The piston can then be pushed out of the top of the cylinder. Use a hammer handle for this operation.

If the rings show wear, replace with new ones. Be sure that ring grooves are free of all carbon, so that rings work freely in groove. The ring group consists of a compression ring in the top groove, a scraper ring in the middle groove (*Be sure that the sharp edge of this ring faces downward toward the piston pin*), and an oil ring in the bottom groove. In replacing piston, be sure to stagger the split of the rings evenly around the piston. *Never leave them in line.* Be careful not to damage piston rings when entering cylinder bore. Never use a screw driver to collapse rings. Instead, use a ribbon of sheet steel about three-quarter inch ($\frac{3}{4}$ ") wide, folding the two ends outward about one-half inch ($\frac{1}{2}$ "). This makes an ideal ring collapser. Collapse the rings, tap top of piston lightly, and be sure rings enter freely.

CAUTION: Be sure to replace cotter pins in connecting-rod bolts.

After engine is joined to base, remove the breather from the engine. This will expose the valve cam. **CAREFULLY NOTE:** Be sure oil-pump-arm roller is riding on cam next to cam-shaft boss on cylinder.

NOTE: Consult clearance chart as to piston and ring clearance.

r. Piston Pin.—The piston pin in this engine is furnished only in standard size. Consult clearance chart when necessary to renew. To renew piston pin, remove retainer rings, heat piston in boiling water, and drive out pin with wooden plug. **CAUTION:** Be sure to replace retainer rings. Failure to do this will result in scored cylinder bore.

s. Connecting Rod.—The connecting-rod bearing is of the steel-backed, babbitt-lined, inlaid-bearing type. These bearing liners are easily replaced when excessive wear occurs. (See chart of allowable clearances for wear, page 18). The connecting rod is not provided with shims. To adjust, remove and replace liners with new ones. *Don't attempt to take up wear by filing bearing caps.* No machine fitting is necessary. **NOTE:** The marks on the connecting rod and rod cap should be in line. **CAUTION:** Never attempt to secure the proper

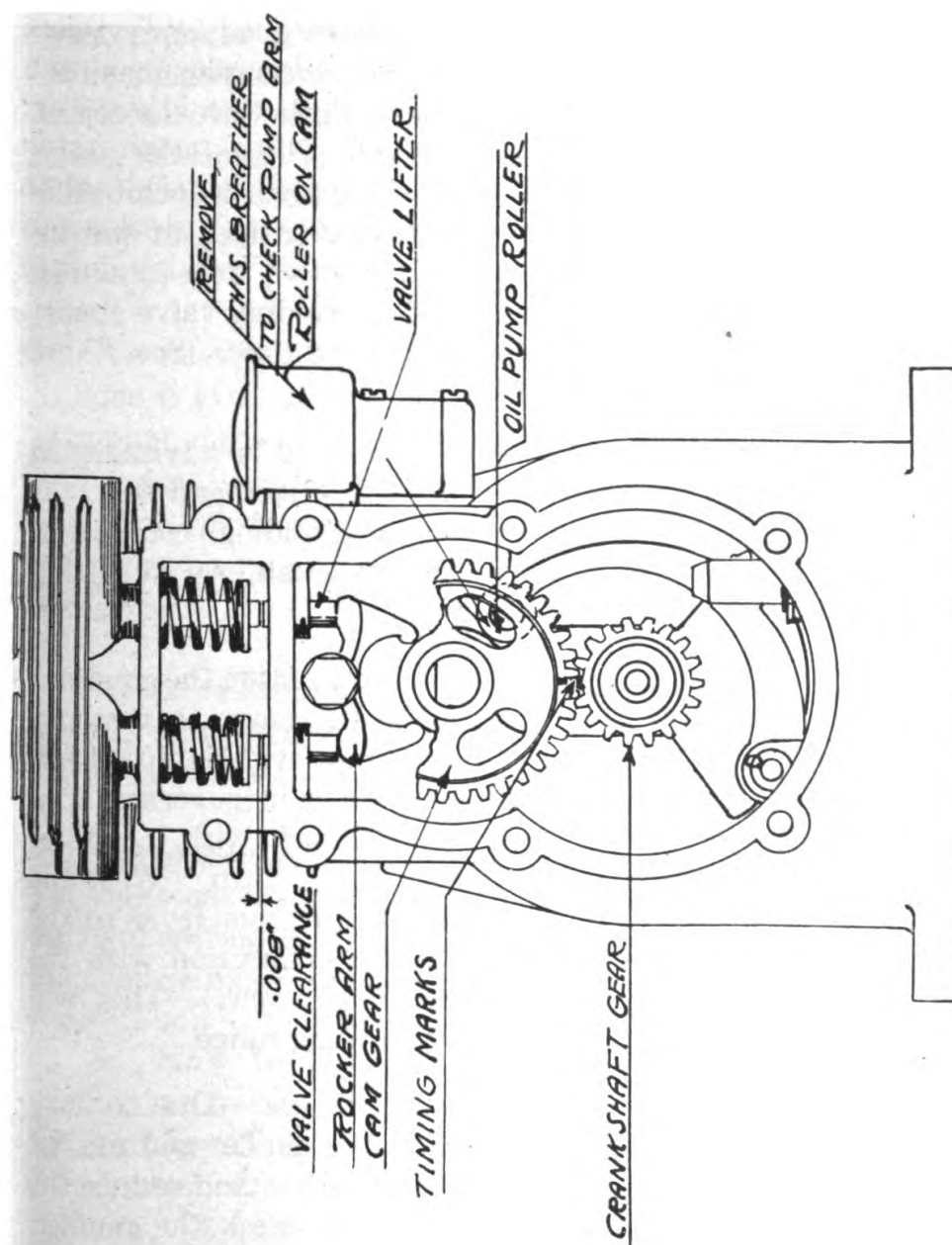


Figure 5—Valve Clearance and Timing

adjustment of the connecting-rod bearings by adjusting the rod bolts. This is dangerous and may damage the engine, for these bolts, if not tight, may work loose.

t. How to Check Valve Clearance.—Remove the fuel tank, flywheel housing, flywheel, cylinder head and valve-spring cover plate. This will expose the valve-spring chamber. Turn the crankshaft until the piston is flush with the top of the cylinder and both valves are closed. Slip a feeler gauge between the valve stem end and the valve tappet. (See Figure 5). If the clearance is less than .008 inch, it will be necessary to grind or file the end of the valve stem to obtain the correct clearance. Be careful when grinding valve stems, not to grind them too far. Grind a little at a time. (See Chart of Clearances—Section IV, 10, a).

While checking the valve clearance, it is advisable to remove valve springs and check the valve face and seat. If necessary, grind them in with valve-grinding compound. NOTE: Do not use a coarse grade of compound. Avoid getting compound in other parts of the engine.

u. To Adjust Governor.—If for any reason the governor does not function properly, it will be necessary to properly adjust it. To do this, loosen governor-lever-clamp screw, leaving governor spring hooked in position in governor arm. Grasp the end of the governor-throttle shaft with a pair of pliers and turn to the left as far as it will turn. With the governor shaft in this position, and the governor lever to the left as far as it is permitted to move in connection with the carburetor, tighten governor-lever-clamp screw. This will permit governor to have a complete working range.

v. Muffler and Exhaust Hose or Pipe.—Due to long periods of operation, it is possible that the muffler and muffler nipple will become clogged with soot or carbon and reduce the engine power through back pressure. To check the muffler, run water into the open end. If a full stream of water runs out of the opposite end, the muffler is not clogged. Where exhaust hose or pipe is used between engine and muffler, be sure hose or pipe is open. If muffler is clogged, replace it. Before replacing muffler, be sure to clean out exhaust opening in cylinder.

w. How to Remove Crankshaft.—Drain the oil from the crankcase. Remove flywheel, blower housing, magneto flywheel, flywheel key, breaker cam, cam-spacing collar, magneto breaker-plate assembly, rear-bearing plate, cam and gear, cylinder head, governor-control shaft and engine base. Next remove bolts and cap for connecting rod. Push the connecting rod and piston up through the cylinder. NOTE: Use a hammer handle or wooden stick for this operation. Remove the crankshaft from the cylinder block by driving on end of shaft with a wooden block and hammer or a piece of lead.

To remove either ball bearing or gear, use a wheel puller. If none is available, clamp the crankshaft in a vise. The best clamping place on the crankshaft is on the crank-bearing end under the balance weight. A brass rod or hardwood stick such as a short piece of broom handle should be used to drive off either bearing or gear. Tap evenly and lightly to remove these parts.

When re-assembling crankshaft into crankcase, insert ball bearing straight into hole. To start it, tap lightly with a brass bar or hardwood stick. Tap evenly around the bearing edge.

On re-assembling the engine, be sure to fasten connecting-rod bolts securely, also see that pump-arm roller is on the valve-operating cam. Remove breather assembly on side of cylinder to check the pump-arm roller.

x. How to Remove Bearing Plate.—Drain oil from engine, remove flywheel, blower housing, magneto flywheel, flywheel key, breaker cam and spacer and magneto breaker-plate assembly. Remove screws holding bearing plate to cylinder. It may be necessary to tap the plate lightly with a wooden block or hammer. To remove bearing from plate, heat plate in boiling water. This will expand the metal enough to allow the removal of the bearing. A wooden block may be used to drive out the bearing and to drive the new bearing in place. NOTE: *Never use a steel hammer on any bearing.*

y. How to Check Timing of Valves.—The valves, when properly timed, should both be closed when the piston is on top, dead center. If not, it will be necessary to remove the bearing plate.

Note the marking on the cam gear and crankshaft gear. The cam gear has a notch which must coincide with the beveled tooth on the crankshaft gear. (See Figure 5).

11. GENERATOR MAINTENANCE.—**a.** If the generator does not produce its rated output of .5 kw with 80% power factor at 110 volts, the brushes may not be seating properly on the commutator. Stop the engine. Remove the generator end-bell and lift one of the four d-c brushes from it's holder and observe whether or not the face of the brush has a shiny surface conforming to the shape or curve of the commutator. If it is not making contact over its entire surface, it must be reset. To reset brushes, slip a strip of No. 00 sand paper (*not emery*) beneath the brushes on the commutator with the sandy side toward the brushes. Move the crankshaft back and forth until the brushes are cut to conform to the commutator curve. The brushes will not have a shiny surface after this treatment, but will attain such a surface after being run a while.

The generator requires no lubrication.

b. Commutator and Collector Rings.—To inspect commutator and collector rings, remove two screws in generator end-bell and remove end-bell. Give it a quarter inch ($\frac{1}{4}$ ") twist to the left when facing it, and slip it off. This exposes the generator-brush-bracket assembly. The commutator and collector rings should require no cleaning for several hundred hours of operation. They need be cleaned only when excessively carbonized or scored, or when arcing occurs.

c. To Clean Commutator and Collector Rings.—Remove end-bell of generator and brush-bracket assembly. Swing brush-bracket assembly out of the way and tie it with a string to prevent its slipping into revolving armature. Replace fan and armature bolt to hold armature in place. Start the engine. Place a strip of fine sand paper (*not emery*)

No. 00 to 8/0 on top of commutator, using the rubber end of a pencil to guide it. Exert a slight pressure of the pencil, holding one end of the sand paper strip. Move back and forth across the commutator until clean.

d. Brushes.—The generator brushes should be inspected every 300 hours of operation. They require replacement when the brush spring is almost touching the collector rings.

To reset brushes so they fit properly and conform to the shape of the commutator, place strip of No. 00 sand paper underneath the brush with the sand side up facing the brush. Rock the engine back and forth by hand at the same time exerting a very slight pressure on the brushes, which will be cut to the same arc as the commutator itself.

Brushes must ride freely in brush holders and not bind. If it is found that a new brush binds in the holder, remove a little carbon from the binding side with sand paper or a fine file.

e. Control Panel Fuses.—If the generator fails to produce current after a short circuit in the load, inspect the fuses, located on the control panel, and replace burned-out fuses with new ones. (See IV, 12, a).

f. To Remove Generator from the Engine.—First step is to disconnect wiring connections at the generator outlet box. Next remove generator end-bell, armature bolt, fan, and brush-bracket assembly. The armature should be slipped off of the engine shaft also. If the armature is tight on the shaft, a sharp side blow on the commutator with the heel of the hand will loosen it. The armature is mounted on a tapered shaft. At the engine side of the generator and on the inside will be found six studs holding the generator adapter-bracket to the engine crankcase. Remove the nuts and lock-washers, and the generator frame and field assembly may be slipped off the studs. The generator field poles may be removed by taking off the cap screws on the outside of the generator yoke. Be sure and mark each pole, so that they will be re-assembled in the same place and position. The field coils can be slipped off of the pole shoes. If for any reason the field coils are removed, be sure to mark properly, so as to assure re-assembling in the same position.

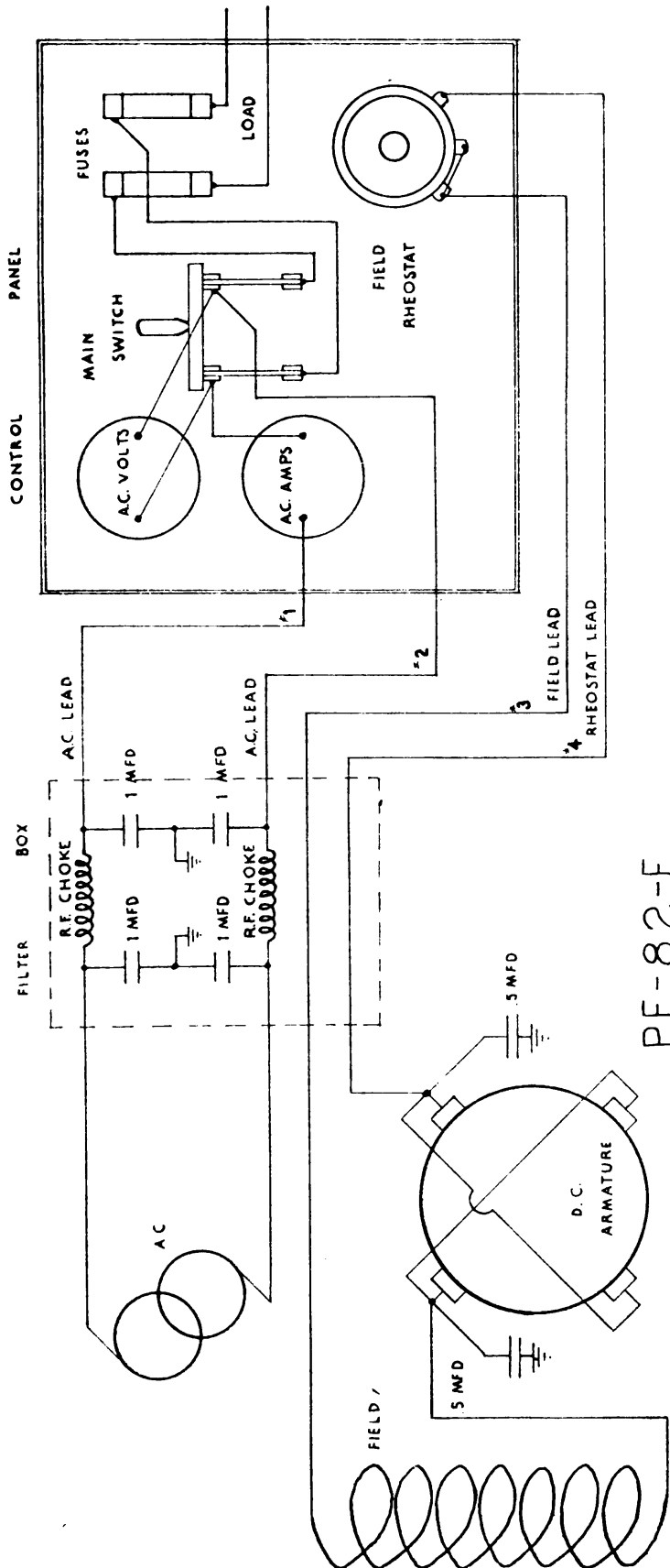


Figure 7—Wiring Diagram of Generator and Control Panel

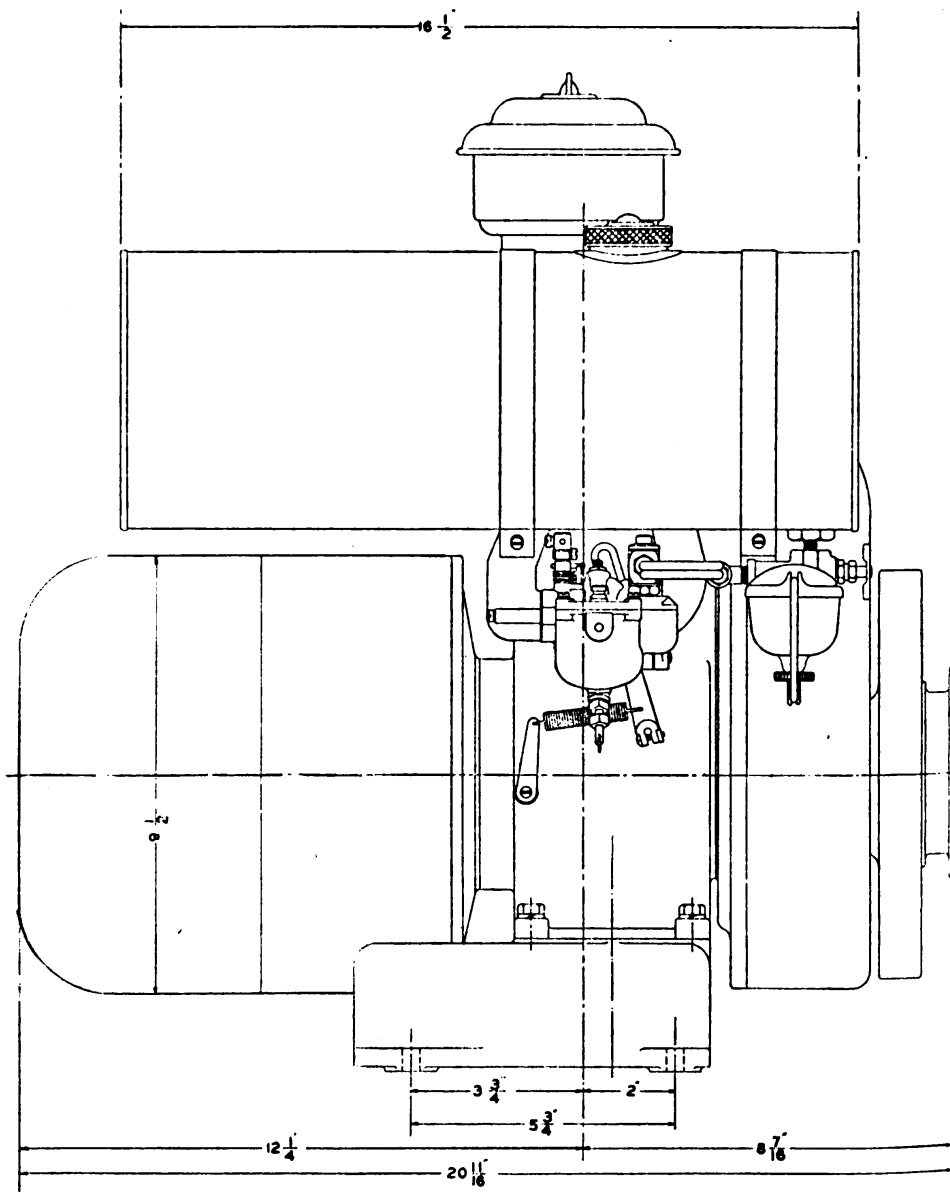


Figure 8—Outline Drawing of Power Unit PE-82-E



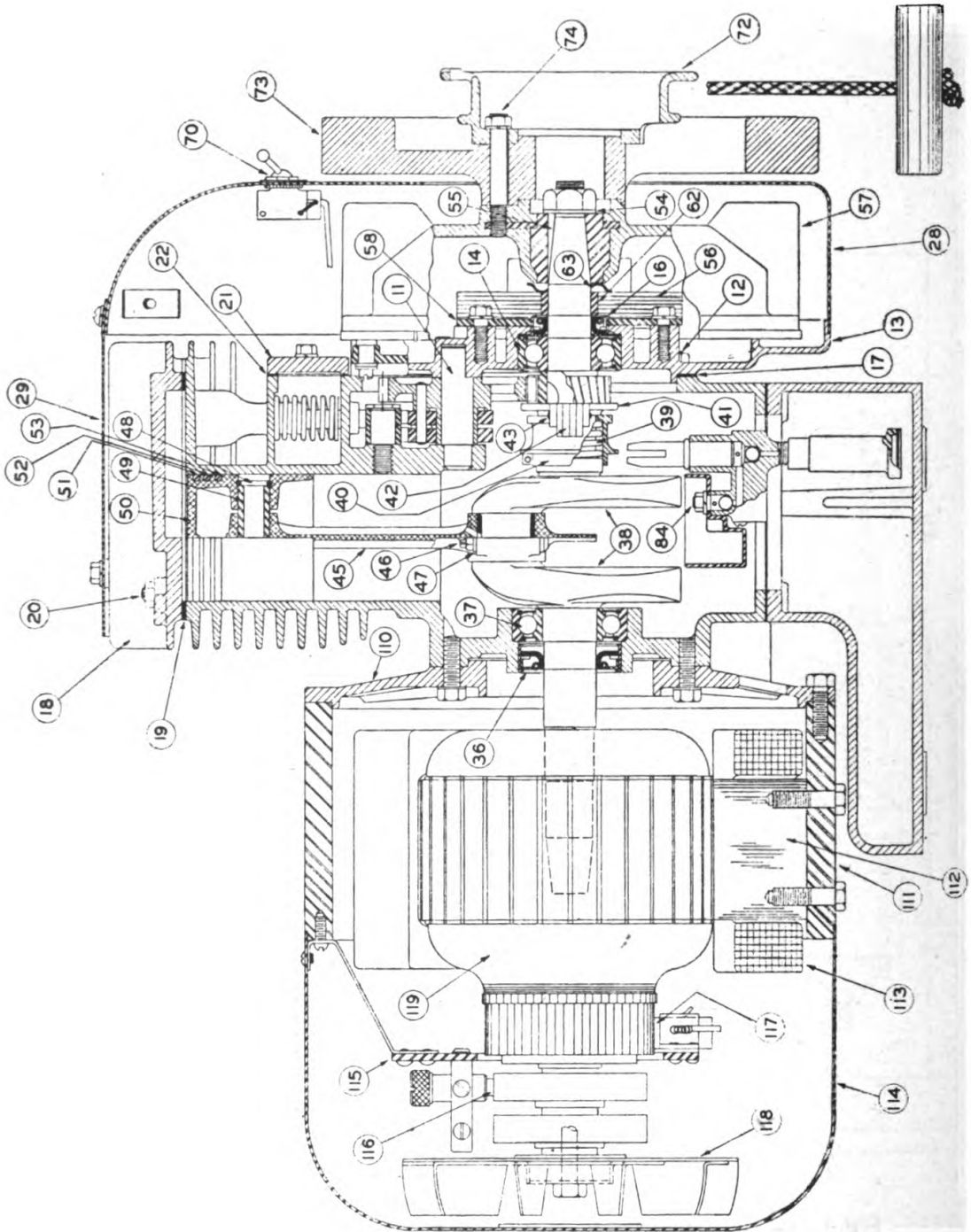


Figure 9—Cross-sectional Drawing, Power Unit PE-82-E

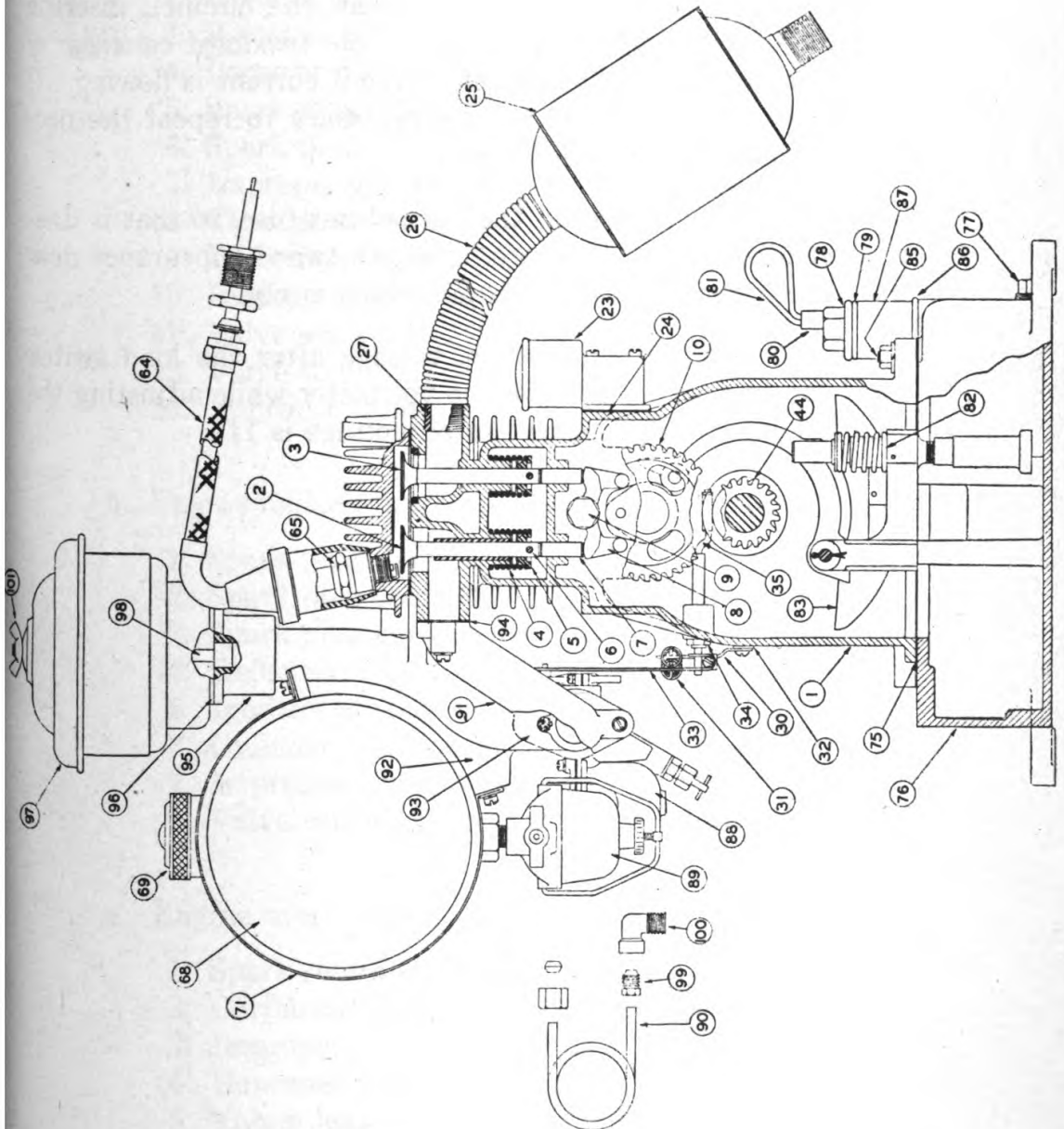


Figure 9—Cross-sectional Drawing, Power Unit PE-82-E

12. CONTROL PANEL.—a. Should a short in the load circuit occur and a fuse be burned out, it will be necessary to replace the burned-out fuse with a new one. It is advisable before replacing the fuse to locate and repair the existing short. The proper way to replace fuses is to either stop engine or throw switch off (in order to break the circuit), insert a new fuse. *Don't touch anything but the insulated cartridge of fuse.* Then throw in the switch to see if current is flowing. If current is not flowing, it will be necessary to repeat the procedure with the next cartridge.

CAUTION: Discard the burned-out fuse, so that it does not get mixed with the spare fuses. Outward appearance does not show which fuse is good and which is not.

b. To obtain the correct voltage after the load switch has been thrown in, observe the voltmeter while adjusting the rheostat knob. The correct rated voltage is 110.

13. TROUBLE CHART—**a. Engine hard to start:**

1. No gasoline in tank..... 5-b
2. Gasoline flow obstructed..... 9-b
3. Water in fuel supply..... 5-b, 9-b
4. Loose or defective wiring..... 10-k
5. Spark plug cracked..... 10-i
6. Spark plug fouled..... 10-j
7. Improper gas mixture..... 10-b
8. Throttle valve stuck..... 10-c
9. Defective magneto..... 10-e, 10-f
10. Intake manifold leaking..... Replace
11. Valve seats bad..... 10-t
12. Valve sticking..... 10-t
13. Improper timing..... 10-t, 10-f

b. Engine missing fire:

1. Spark plug fouled..... 10-j
2. Spark plug cracked..... 10-i
3. Spark plug gap wrong..... 10-i
4. Defective wiring..... 10-k
5. Ignition breaker points sticking..... 10-f
6. Cylinder head gasket leaking..... Replace
7. Improper valve clearance..... 10-a, 10-t
8. Valve warped or broken..... 10-t

c. Engine overheating:

1. Spark retarded too far..... 10-f
2. Carburetor choke partly closed..... 6-a
3. Improper gas mixture..... 10-b
4. Improper timing..... 10-f, 10-t
5. Valves leaking..... 10-t
6. Oil badly diluted..... 5-a, 9-a, 10-q
7. Lack of oil..... 5-a, 9-a, 10-m

d. Engine lacks power:

1. Valve seats worn..... 10-t
2. Piston rings weak or worn..... 10-a, 10-m, 10-q
3. Piston rings sticking..... 10-q
4. Improper gas mixture..... 10-b
5. Improper timing..... 10-f, 10-t
6. Air cleaner needs cleaning..... 9-c
7. Governor or throttle loose..... 10-u
8. Oil badly diluted..... 5-a, 9-a, 10-q

e. Explosion in muffler:

1. Ignition too late..... 10-f
2. Weak spark..... 10-f
3. Valves holding open..... 10-t
4. Exhaust valves warped..... 10-t

f. Engine knocks:

1. Carbon in cylinder..... 10-o
2. Loose main bearings..... 10-w, 10-x
3. Loose rod bearing..... 10-s
4. Worn piston and cylinder..... 10-q, 10-n
5. Loose valve lifters..... 10-a, 10-t
6. Motor overheated..... 10-f, 10-o, 10-t
7. Tight Piston..... Replace,
5-a, 10-l, 10-m
8. Loose flywheel..... Tighten flywheel
unit
9. Lack of oil..... 5-a, 10-l, 10-m

g. Faulty carburetion:

1. Carburetor improperly adjusted..... 10-b
2. Valves leaking..... 10-t
3. Intake manifold leaking..... Replace
4. Gaskets leaking..... Replace
5. Shut-off valve closed..... Open
6. Using too much fuel..... 10-b, 10-n, 10-q
7. Water in fuel..... 5-b, 9-b
8. Sediment in fuel tank..... 5-b, 9-b

h. Excessive smoke in exhaust:

- | | |
|---|---------------|
| 1. Too much oil in crankcase | 9-a |
| 2. Carburetor needle valve open too far | 10-b |
| 3. Carburetor float sticking or leaking | Replace, 10-c |
| 4. Lubricating oil too thin to seal pistons | 5-a |

i. Backfire through carburetor or intake:

- | | |
|-------------------------------------|---------------|
| 1. Gas mixture too lean | 10-b |
| 2. Intake valves sticking | 10-T |
| 3. Cylinder head gasket leaking | Replace |
| 4. Intake valve springs weak | Replace |
| 5. Intake manifold leaking | Replace |
| 6. Intake valves warped or broken | Replace, 10-t |
| 7. Intake valve clearance too small | 10-a, 10-t |
| 8. Incorrect timing | 10-f, 10-t |

j. Poor Compression:

- | | |
|----------------------------------|------------------------|
| 1. Valves not seating | 10-t |
| 2. Valves sticking | 10-t |
| 3. Cracked spark plug | 10-i |
| 4. Valve clearance set too close | 10-t, 10-a |
| 5. Piston rings worn or broken | Replace,
10-q, 10-a |
| 6. Worn piston and cylinder | 10-q |
| 7. Piston rings sticking | 10-q |
| 8. Loose spark plug | Tighten |
| 9. Cylinder head loose | Tighten |
| 10. Cylinder head gasket leaking | Replace |
| 11. Oil too thin to seal piston | 5-a |
| 12. Scored cylinder | Replace |

SECTION V SUPPLEMENTARY DATA

TABULAR LIST OF REPLACEABLE PARTS ENGINE BLOCK AND VALVE GROUP

Ref. No.	No. in Equip.	Signal Corps Stock No.	Name of Part and Description	Function	Mfg'r's. Code	Mfg'r's. Part No.
1	† 1	3H1903-1/B40	Cylinder and Engine Block	Frame of engine	LAU	TL-1-31
2	† 1	3H1903-1/V1	Intake Valve	Admits gas mixture	LAU	TL-20
3	† 1	3H1903-1/V2	Exhaust Valve	Exits burned gas mixture	LAU	TL-66-1
4	† 2	3H1903-1/S30	Valve Spring	Closes valve	LAU	TL-57
5	† 2	3H1903-1/W2	Valve Spring Washer	Holds valve spring	LAU	TL-50-1
6	† 2	3H1903-1/P15	Valve Spring Washer Pins	Holds valve spring washer	LAU	TL-258
7	† 2	3H1903-1/T2	Valve Lifters	Lifts valve	LAU	TL-63
8	2		Rocker Arms	Raise valve lifter	LAU	TL-65-3
9	1		Rocker Arm Stud	Holds rocker arm	LAU	TL-78-1
10	1		Cam Gear Assembly	Actuates rocker arm	LAU	TL-1009
11	1		Cam Gear Shaft	Holds cam gear	LAU	TL-28-A

† Available in Depot Stock

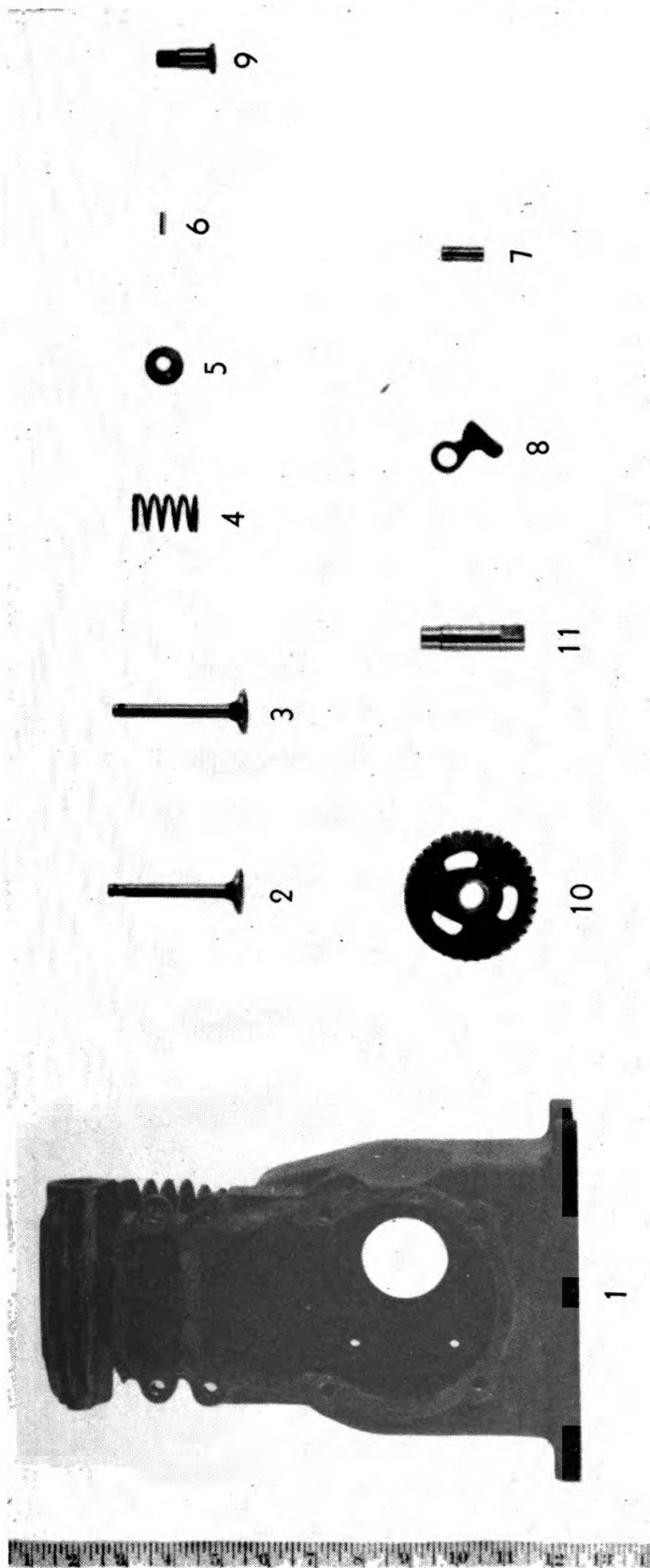


Figure 10—Engine Block and Valve Group

Figure 10

**TABULAR LIST OF REPLACEABLE PARTS
BEARING PLATE AND CYLINDER HEAD GROUP**

Ref. No.	No. in Equip.	Signal Corps Stock No.	Name of Part and Description	Function	Mfgr's. Code	Mfgr's. Part No.
12	3		Bearing Plate Studs	Hold bearing plate to block	LAU	TL-61-1
13	1		Bearing Plate	Holds crankshaft bearing	LAU	TL-109-6
14	† 1	3H2707A/B2	Ball Bearing	Crankshaft main bearing	NDBB	7750-4
15	† 1		Grommet	Insulates ground wire	LAU	TL-488
16	† 1	3H1903-1/S11	Oil Seal, Bearing	Seal ball bearing	NMB	50023
17	† 1	3H1903-1/G2	Gasket, Bearing Plate	Seal bearing plate to cylinder block	LAU	TL-126
18	† 1	3H1903-1/H10	Cylinder Head	Cylinder cover	LAU	TL-4-5
19	† 1	3H1903-1/G1	Gasket, Cylinder Head	Seal between cylinder head and block	LAU	TL-114
20	† 6	6H6226/K13	Studs, Cylinder Head	Secures cylinder head to block	LAU	RA-68-A

† Available in Depot Stock

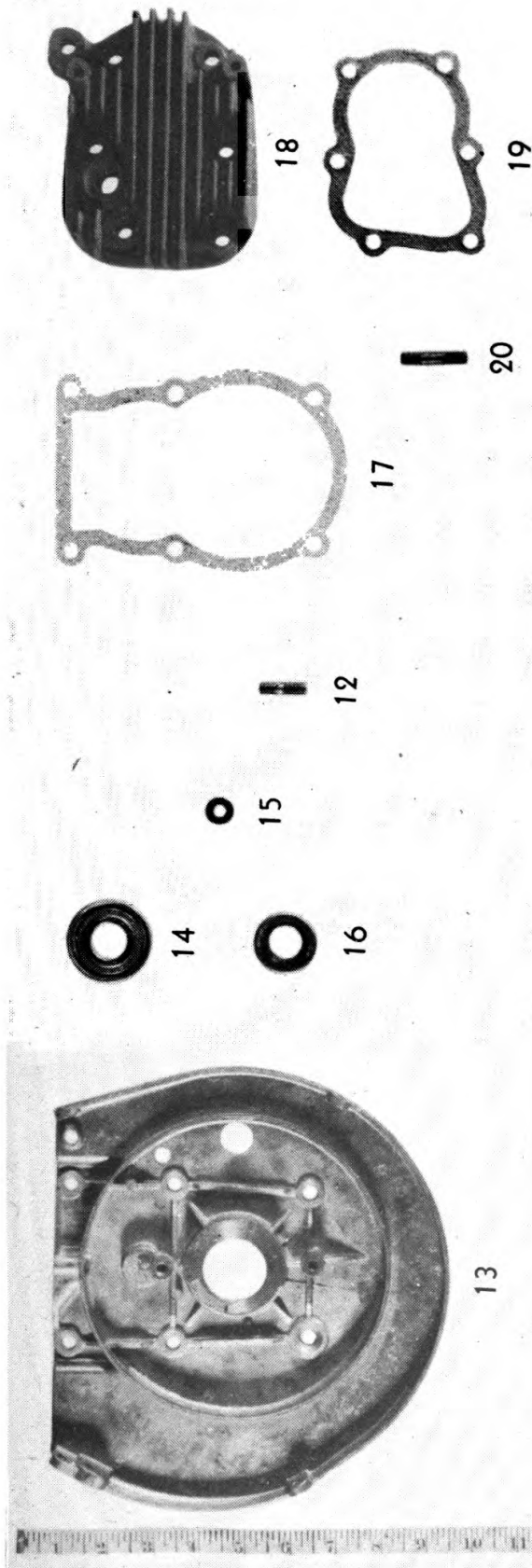


Figure 11—Bearing Plate and Cylinder Head Group

Figure 11

TABULAR LIST OF REPLACEABLE PARTS
VALVE SPRING COVER, BREATHER, MUFFLER AND BLOWER HOUSING GROUP

Ref. No.	No. in Equip.	Signal Corps Stock No.	Name of Part and Description	Function	Mfgr's. Code	Mfgr's. Part No.
21	1		Valve Spring Cover	Cover valve spring compartment	LAU	TL-18-2
22	† 1	3H1903-1/G4	Gasket, Valve Spring Cover	Seal valve spring cover to block	LAU	TL-217-1
23	† 1	3H1903-1/B25	Breather Assembly	Outlet for crankcase gases	LAU	RL-1393-4
24	† 1	3H1903-1/G5	Gasket, Breather	Seal breather to cylinder block	LAU	RL-397-A
25	† 1	3H1903-1/M20	Muffler Assembly	Silence exhaust	LAU	TL-1443-A
26	† 1	3H1903-1/T25	Exhaust Tube Assembly	Connect muffler to engine	LAU	TL-1552
27	† 1	3H1903-1/N25	Nipple, Muffler	Connect exhaust tube to block	LAU	½" CLOSE
28	1		Blower Housing	Controls airflow over cylinder	LAU	TL-1104-28
29	1		* Air Deflector	Airflow control over cylinder head	LAU	TL-236

† Available in Depot Stock

* Not shown in Illustrations

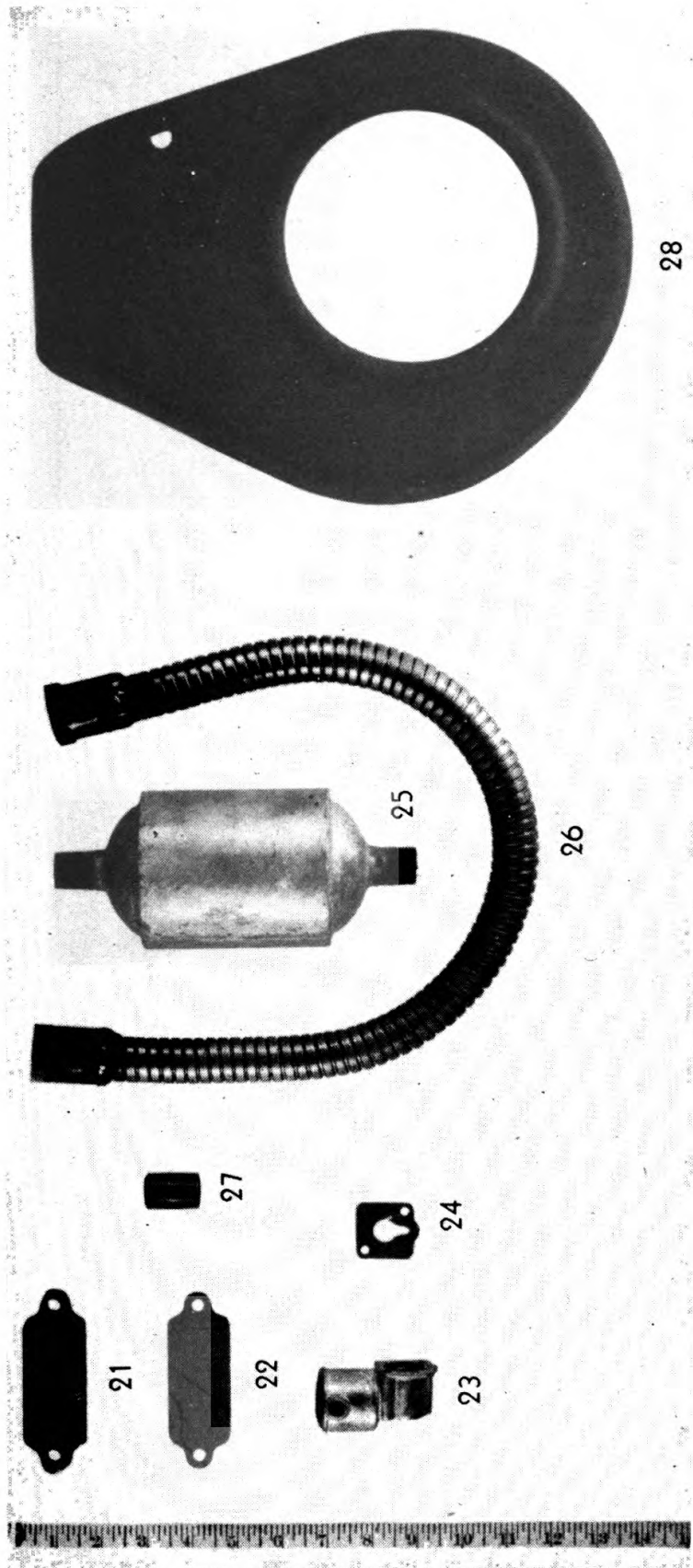


Figure 12—Valve Spring Cover, Breather, Muffler and Blower Housing Group

Figure 12

**TABULAR LIST OF REPLACEABLE PARTS
GOVERNOR AND CRANKSHAFT GROUP**

Ref. No.	No. in Equip.	Signal Corps Stock No.	Name of Part and Description	Function	Mfgr's. Code	Mfgr's. Part No.
30	1		Speed Adjustment Lever	Hold governor spring	LAU	RL-184
31	† 1	3H1903-1/S31	Governor Spring	Provide tension to throttle lever	LAU	RL-562-4
32	2		Washer, Speed Adjustment	Spacer, block and speed adjust. lever	LAU	RA-92
33	1		Throttle Lever	Moves carburetor valve	LAU	TL-55-5
34	† 1	3H1903-1/B16	Bearing, Governor Shaft	Bearing	LAU	TL-175
35	† 1	3H1903-1/S20	Governor Throttle Shaft Assbly.	Transmits governor changes through Cyl. Block	LAU	TL-1052
36	† 1	3H1903-1/S10	Oil Seal, Power Takeoff Side	Seals main bearing	NMB	50040
37	† 1	3H305-3	Ball Bearing	Main crankshaft bearing	NDBB	7750-5
38	† 1	3H1903-1/C50	Crankshaft	Main power shaft	LAU	TL-24-29
39	† 1	3H1903-1/S32	Governor Spring	Provides tension against gov. collar	LAU	TL-183-2
40	1		Governor Collar	Actuates governor throttle shaft	LAU	TL-472-1
41	1		Governor Yoke	Holds governor weights	LAU	TL-56-1
42	8		Governor Weights	Actuates governor	LAU	RL-10
43	2		Rivet	Holds governor weights	LAU	7/64 x 1
44	1		Crankshaft Gear	Drive cam gear	LAU	TL-12

† Available in Depot Stock

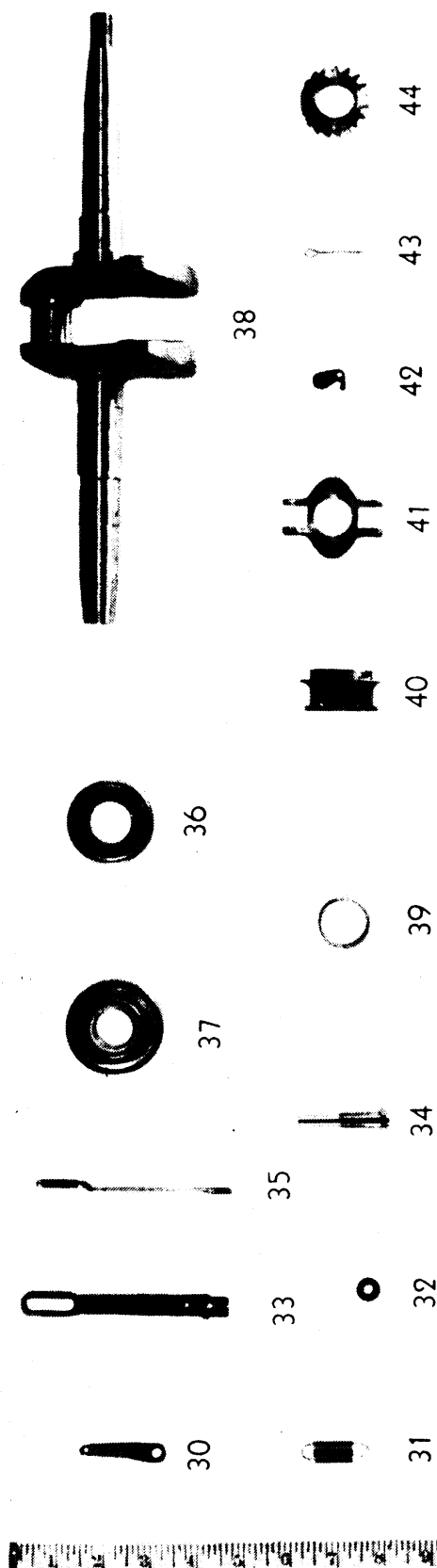


Figure 13—Governor and Crankshaft Group

Figure 13

**TABULAR LIST OF REPLACEABLE PARTS
PISTON ASSEMBLY GROUP**

Ref. No.	No. in Equip.	Signal Corps Stock No.	Name of Part and Description	Function	Mfg'r's. Code	Mfg'r's. Part No.
45	† 1	3H1903-1/R40	Connecting Rod	Transmits power from piston to crankshaft	LAU	RA-1025-9
46	† 2	6H6226/A5	Bolts, Connecting Rod	Join connecting rod halves	LAU	RA-89
47	† 2	6H6226/A6	Washers, Connecting Rod Bolts	For connecting rod bolts	LAU	RA-94
48	† 2	3H1909B/A12	Piston Pin Retaining Rings	Secures piston pin	LAU	RA-23-A
49	† 1	6H6226/A13	Piston Pin	Connects piston to connecting rod	LAU	RA-27
50	† 1	3H1903-1/P30	Piston	Transform power of explosion to crankshaft	LAU	TL-5-1
51	† 1	3H1903-1/R15	Piston Ring, Compression	Seals piston in cylinder	LAU	TL-14
52	† 1	3H1903-1/R16	Piston Ring, Oil Control	Seals and lubricates cylinder wall	LAU	TL-111
53	† 1	3H1903-1/R17	Piston Ring, Oil Scraper	Seals and removes excess oil from cylinder wall	LAU	TL-484
53A	† 2	3H1903-1/B15	Bearing, Connecting Rod		LAU	RA-6

† Available in Depot Stock

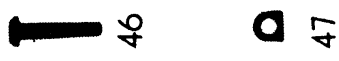


Figure 14—Piston Assembly Group

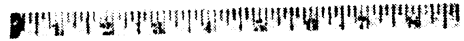


Figure 14

TABULAR LIST OF REPLACEABLE PARTS MAGNETO GROUP

Ref. No.	No. in Equip.	Signal Corps Stock No.	Name of Part and Description	Function	Mfgr's. Code	Mfgr's. Part No.
54	† 1	3H2699-10/W1	Washer, Magneto	Used with flywheel nut	LAU	RL-645
55	† 1	6H6226A/R37	Flywheel Key	Secures flywheel to crankshaft	LAU	TL-88
56	† 1	3H2699-10	Magneto Assembly	Provides ignition current	EM	71-R
57	1		Flywheel with Magnet	Works with magneto	EM	23401
58	1		Stator Assembly Complete	Magneto control and coil	EM	23408
59	† 1	3H1909A/T17	Magneto Breaker Point, Stationary	Contact point	EM	22337
60	† 1	3H1909A/T15	Magneto Breaker Lever	Movable contact	EM	22671
61	† 1	3H2699-10/C1	Condenser, Magneto Breaker Cam	Reduces contact arc	EM	23242
62	1		Thrust Washer for Breaker Cam	Actuates breaker lever	EM	23410
63	1		Radio Shielded Ignition Wire	Secures breaker cam	EM	23411
64	† 1	3H1903-1/W20	* Spark Plug, 14 mm.	Connects spark plug and magneto	EM	TL-1634-1
65	† 1	3H4412-8	* Block, Stop Switch	Ignition plug	CSP	J-8
66	1		* Insulating Washer	Insulator	LAU	TL-780
67	1			Insulator	LAU	RL-66

† Available in Depot Stock

* Not shown in Illustrations

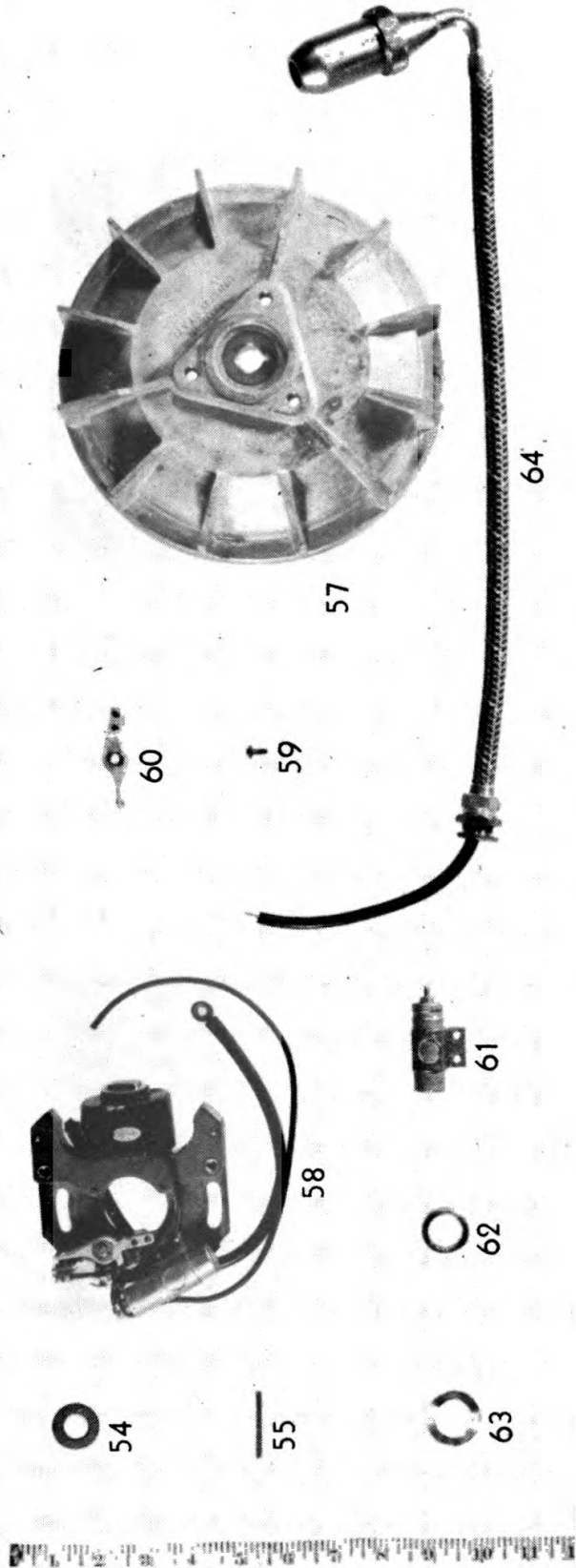


Figure 15—Magneto Group

**TABULAR LIST OF REPLACEABLE PARTS
FUEL TANK AND FLYWHEEL GROUP**

Ref. No.	No. in Equip.	Signal Corps Stock No.	Name of Part and Description	Function	Mfgr's. Code	Mfgr's. Part No.
68	† 1	3H1903-1/T1	Fuel Tank Assembly	Fuel reservoir	LAU	TL-1429-2
69	† 1	3H1903-1/C1	Filler Cap Assembly	Fuel tank cap	LAU	RA-1312-6
70	† 1		Stop Switch Assembly	Stops engine		20994-DX
71	† 2	3H1903-1/S42	Strap, Fuel Tank	Holds fuel tank to engine	LAU	TL-409-B
72	† 1	3H190-1/P25	Starter Pulley	For rope starter	LAU	TL-264-2
73	1		Flywheel, Outboard	Maintains even flow of power	LAU	TL-750
74	3		Studs, Flywheel	Secures outboard flywheel to magneto flywheel		
74 A	† 1	6H6226A/R43	* Starter Rope Assembly	Starting rope	LAU	TL-403
					LAU	RA-1585

† Available in Depot Stock

* Not shown in Illustrations.

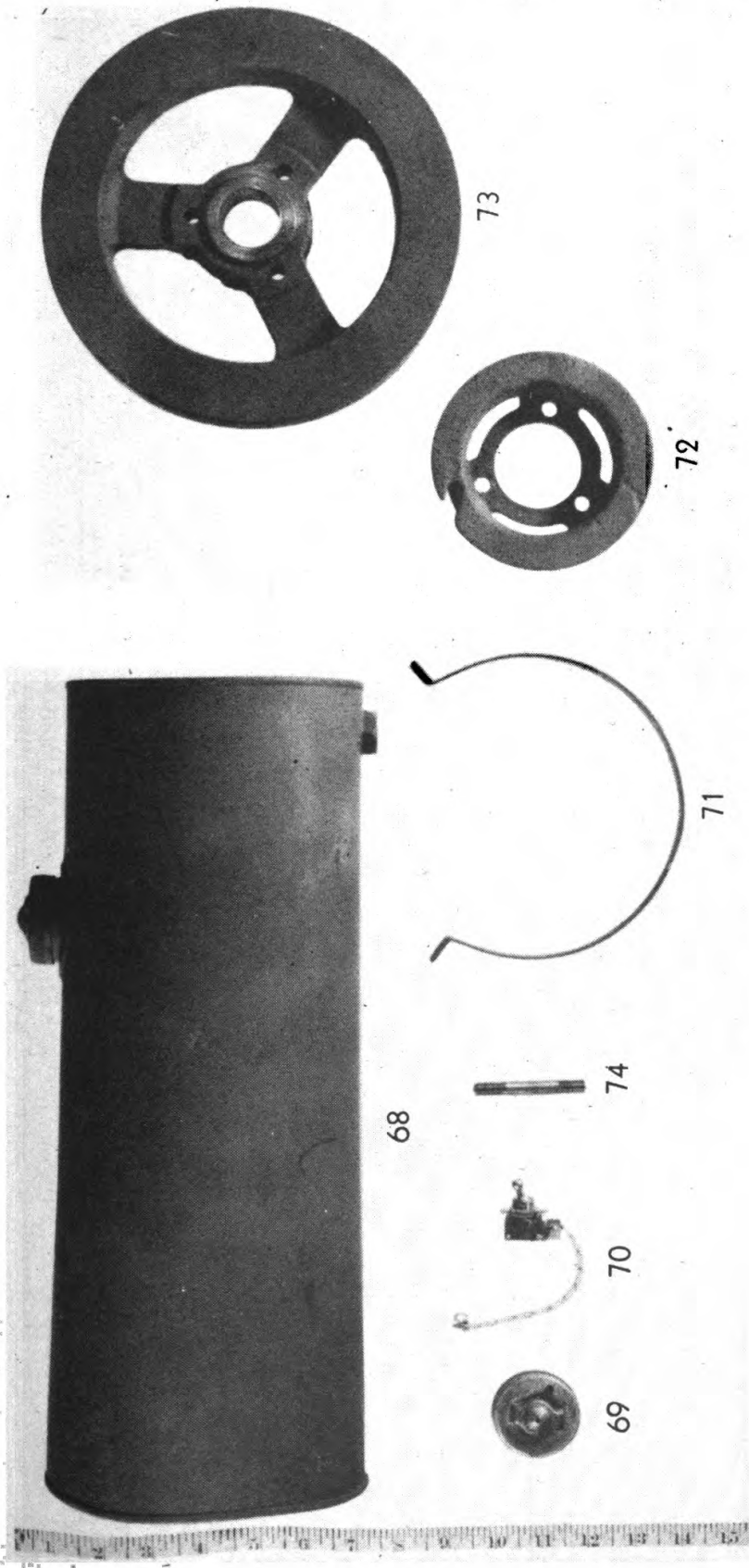


Figure 16—Fuel Tank and Flywheel Group

Figure 16

TABULAR LIST OF REPLACEABLE PARTS
BASE AND OIL PUMP GROUP

Ref. No.	No. in Equip.	Signal Corps Stock No.	Name of Part and Description	Function	Mfgr's. Code	Mfgr's. Part No.
75	† 1	3H1903-1/G3	Gasket, Base	Seals base to cylinder block	LAU	TL-132
76	1		Base	Base of engine	LAU	TL-15-31
77	† 1	3H1903-1/P41	Pipe Plug	Oil drain plug	LAU	¼"
78	† 1	3H1903-1/P40	Oil-Filler Plug	Oil entrance	LAU	RL-85
79	† 1	3H1903-1/W1	Gasket, Oil-filler-plug	Seals oil filler plug	LAU	RL-86-A
80	1		Oil Gauge Tube	Holds oil-gauge stick	LAU	TL-692
81	† 1	3H1903-1/S4	Oil Gauge Stick	Measures oil	LAU	TL-693-1
82	† 1	3H1903-1/P50	Oil Pump Assembly	Distributes oil	LAU	RL-1361-18
83	1		Oil Splash Pan	Holds oil for rod dipper	LAU	RL-362
83A	* 1		Gasket, Oil-Pump Extension	Seals oil pump to extension	LAU	RL-367
84	2		Oil Pump Studs	Secures oil pump to base	LAU	RL-375-1
85	4		Studs, Base	Secures base to cylinder block	LAU	RL-62
86	† 1	3H1903-1/W1	* Gasket, Oil-Filler-Extension	Seals extension	LAU	RL-86-A
87	1		* Extension, Oil-Filler	Part of engine base	LAU	TL-450

† Available in Depot Stock

* Not shown in Illustrations

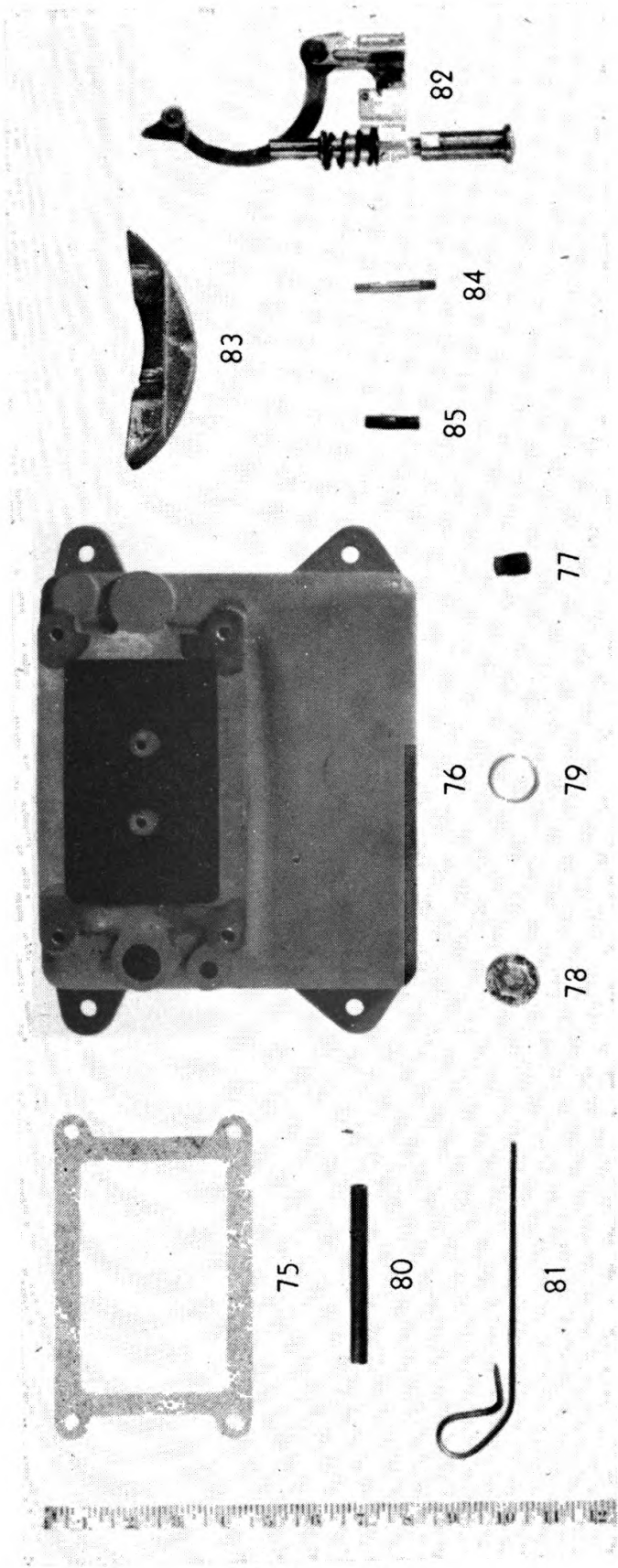


Figure 17—Base and Oil Pump Group

Figure 17

TABULAR LIST OF REPLACEABLE PARTS CARBURETOR AND ADJACENT GROUP

Ref. No.	No. in Equip.	Signal Corps Stock No.	Name of Part and Description	Function	Mfgr's. Code	Mfgr's. Part No.
88	† 1	3H1903-1/C2	Carburetor	Mixes air and fuel	TC	MS-103-A
89	† 1	3H1909A/L13	Sediment-bulb Assembly	Filters fuel	TC	OW-418
90	† 1	3H1903-1/L10	Fuel-Line Assembly	Connects fuel tank and carburetor	LAU	TL-1115
91	1		Intake Pipe	Connects carburetor and cylinder	LAU	TL-319-4
92	1		Bracket, Fuel-Tank	Supports fuel tank	LAU	TL-324-E
93	† 1	6H6226/R16	Gasket, Carburetor	Seals carburetor to intake pipe	LAU	RA-295
94	† 1	3H1903-1/G6	Gasket, Intake-Pipe	Seals intake pipe to cylinder block	LAU	TL-293
95	1		Elbow, Aircleaner	Connects carburetor to aircleaner	LAU	TL-383-3
96	† 1	3H1903-1/97	Gasket, Aircleaner	Seals aircleaner to elbow	LAU	TL-381-2
97	† 1		Aircleaner	Filters air to carburetor	USC	H-40-9385
98	1		Stud, Aircleaner	Fastens aircleaner to elbow	LAU	TL-380
99	1		* Fuel Line Fitting		LAU	R-646
100	1		* Fuel Line Elbow		LAU	R-300-2
101	† 1		Wing Nut, Aircleaner		LAU	TL-379
102	1		Choke Wire	Secures aircleaner to stud	LAU	TL-429
103	† 1	6H6226/S6	Gasket, Inlet-Seat	Actuates carburetor choke	TC	0337
104	† 1	3H710A/31	Gasket, Main-Nozzle	Seals carburetor inlet	TC	06076
105	† 1	6H6226/S17	Gasket, Float Bowl	Seals main nozzle	TC	0-1845
106	† 1	6H6226/S7	Gasket, Main-Screw-Gland	Seals float bowl	TC	0676
107	† 1	3H710A/30	Main Nozzle	Seals needle valve	TC	6075
108	† 1	3H710A/50	Idle Tube	Mixes fuel and air	TC	06080
109	† 1	6H6226/S30	Inlet Needle and Seat	Mixes at idle speed	TC	
				Admits fuel to carburetor	TC	04050

† Available in Depot Stock

* Not shown in Illustrations

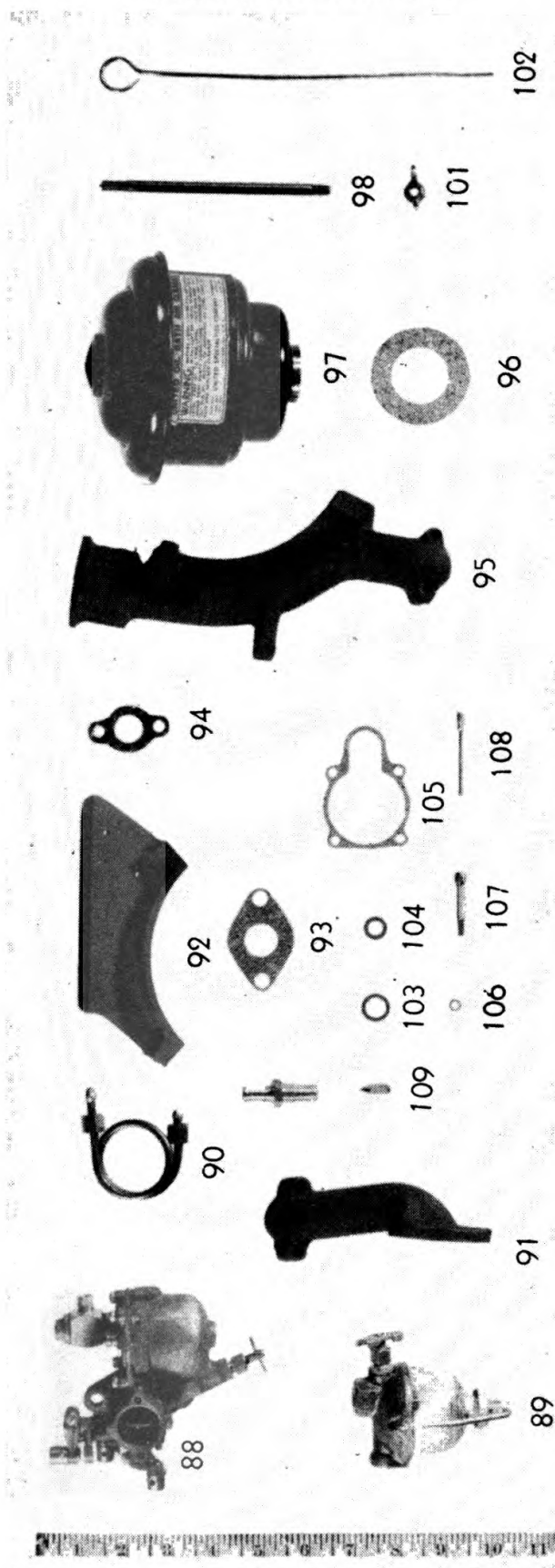


Figure 18—Carburetor and Adjacent Group

Figure 18

**TABULAR LIST OF REPLACEABLE PARTS
GENERATOR GROUP**

Ref. No.	No. in Equip.	Signal Corps Stock No.	Name of Part and Description	Function	Mfgr's. Code	Mfgr's. Part No.
110	1		Generator Adapter Bracket	Supports generator frame to engine	ME	50045
111	1		Generator Frame	Body of generator	ME	50199
112	4		Field Pole-Shoes	Field coil cores	ME	S-50049
113	1		Field-Coil Assembly	Energizes field poles	ME	
119	1		Armature Assembly	Generates current	ME	S-50044

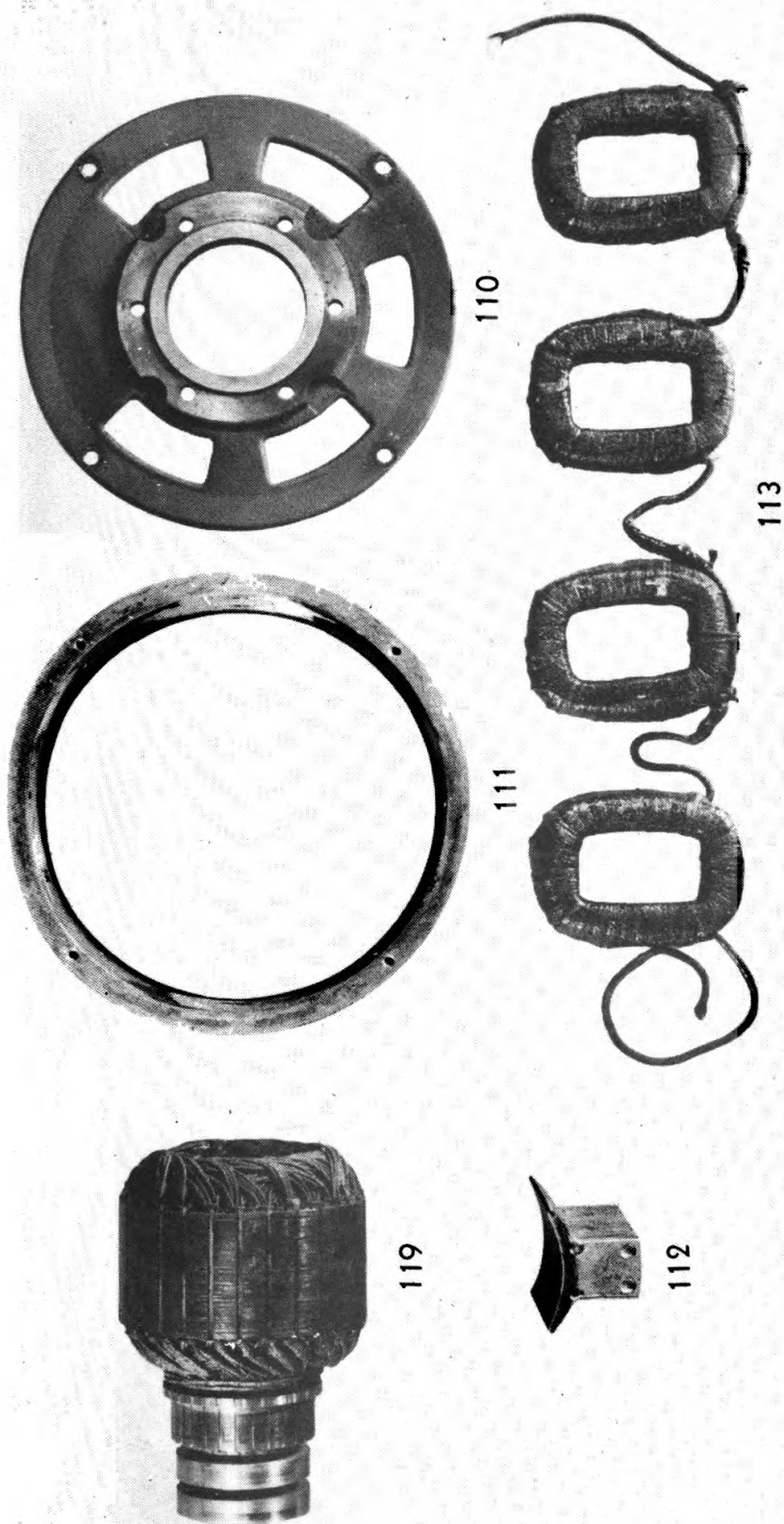


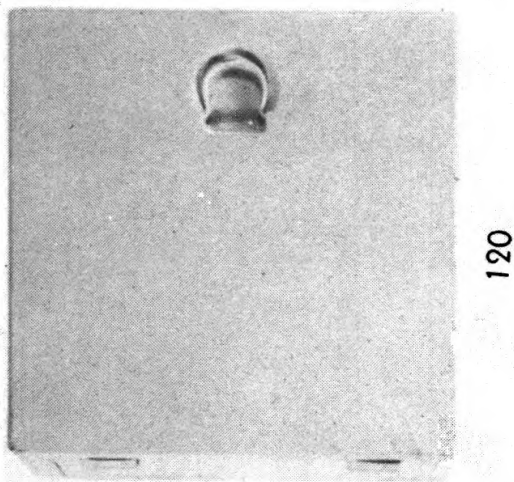
Figure 19—Generator Group

TABULAR LIST OF REPLACEABLE PARTS **CONTROL PANEL GROUP**

Ref. No.	No. in Equip.	Signal Corps Stock No.	Name of Part and Description	Function	Mfg'r's. Code	Mfg'r's. Part No.
120	1		Hinged Cover Metal Control Box	Contains controls	CE	PE-82
121	† 1		Voltmeter, 0-150 Volts A. C.	For reading voltage	RR	55;348-P
122	† 1		Ammeter, 0-10 Amps, A. C.	For reading amperage	RR	55;36-3
123	† 1	3Z7006-2	Rheostat	Regulates voltage	OM	J-0312
124	† 1		* Knob	For rheostat	OM	5100
125	† 1	3Z9817-3.5	Knife Switch, 2 Pole, 115 Volt	Main switch	TR	785
126	† 4	3Z1021-2	Fuse Clips, 30 Amp.	Holds fuses	TR	17386
127	† 2	3-2010	Fuses, 10 Amp., Cartridge Type	Opens circuit when overloaded	OMC	17386-A
128	† 1		Panel, Ebony Asbestos	Holds instruments		

† Available in Depot Stock

* Not shown in Illustrations



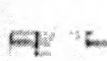
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125



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127

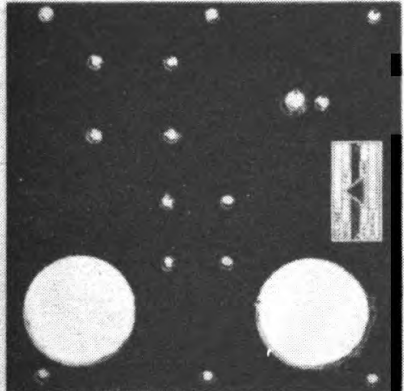
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121



122



128

Figure 20—Control Panel Group

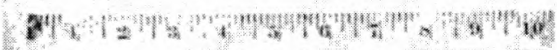


Figure 20

TABULAR LIST OF REPLACEABLE PARTS
GENERATOR AND FILTER BOX GROUP

Ref. No.	No. in Equip.	Signal Corps Stock No.	Name of Part and Description	Function	Mfgr's. Code	Mfgr's. Part No.
114	1		Generator End Cover	Covers end of generator	ME	S-50002
115	† 1	3H2456/B20	Brush-Holder-Bracket Assembly	Holds brushes	ME	S-50026
116	† 2	3H2456/B10	A. C. Brush & Spring Assembly	Collects A. C. current	ME	S-50011
117	† 4	3H2456/B11	D. C. Brushes	Collects D. C. current	ME	S-50024
118	1		Fan Assembly	Cools generator	ME	S-50004
129	2		* BX Connectors— $\frac{1}{2}$ "		TR	$\frac{1}{2}$ " BX
130	1		Hinged Cover Metal Filter Box	Holds filters	MID	PE-130
131	† 1		Condenser (4, 1 mfd.) A. C.	Radio noise filter	ICC	7360
132	† 2		R. F. Choke Coils	Radio noise filter	MID	PE-132
133	† 2		Condensers (.5 mfd. tubular)			
			D. C.	Radio noise filter	ICC	7651
	† 1 *	3H2456	Complete Generator Assembly	Generates Electricity	ME	C-794

† Available in Depot Stock

* Not shown in Illustrations

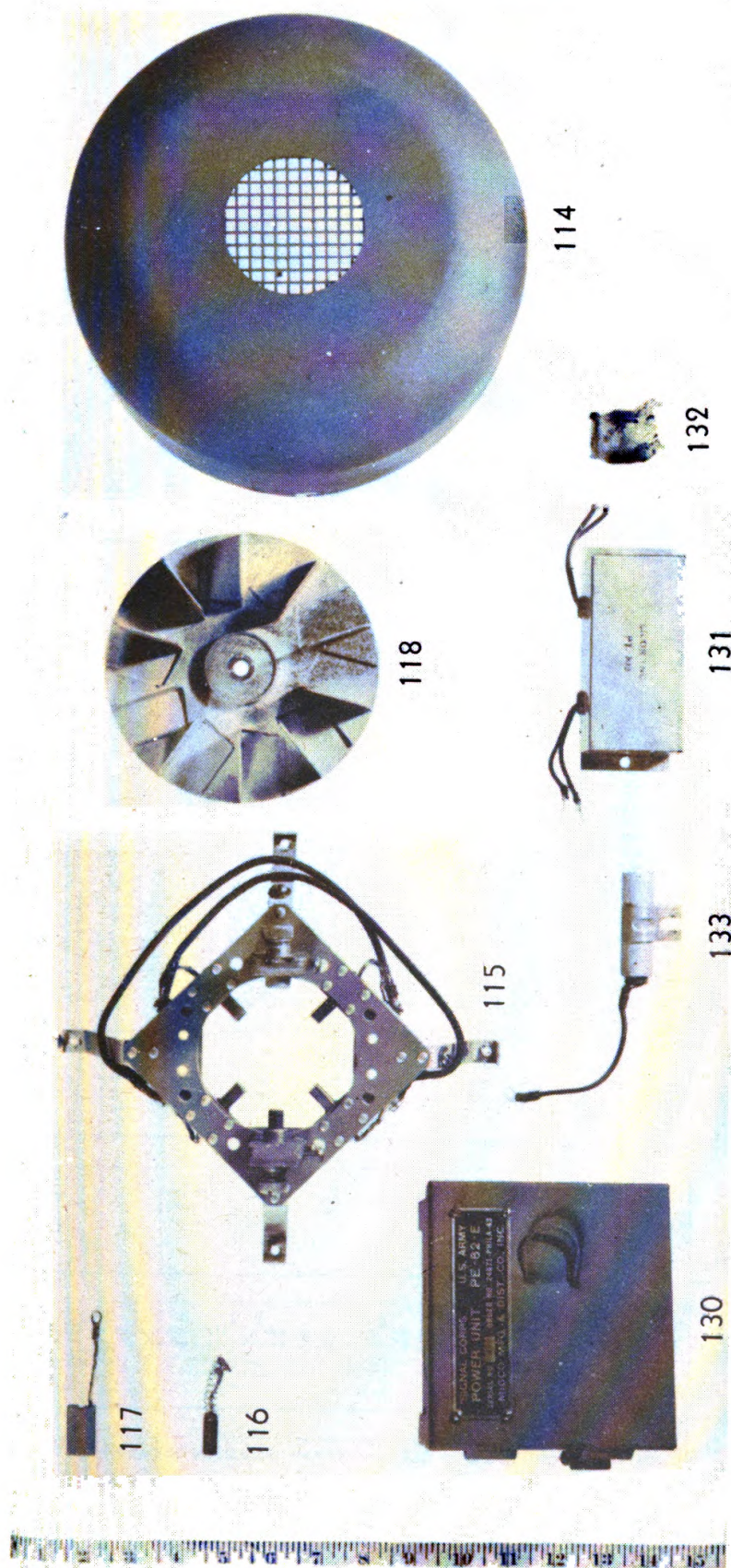


Figure 21—Generator and Filter Box Group

Figure 21

TABLE OF NUTS, BOLTS, SCREWS AND WASHERS

Qty.	Size	Length	Thread	Description	Where Used
2	1/4"		28	Hexagon Nut	Secure Oil Pump
2	1/4"		28	Lockwasher	
2	1/4"	5/8"	20	Fillister Head Screw	Secure Carburetor
2	1/4"			Lockwasher	
2	1/4"	1"	20	Fillister Head Screw	Secure Intake Pipe
2	1/4"			Lockwasher	
2	1/4"		20	Fillister Head Screw	Secure Fuel Tank Bracket
2	1/4"		20	Lockwasher	
4	1/4"	3/8"	20	Round Head Screw	Secure Air Deflector
4	1/4"			Lockwasher	
2	1/4"	1 1/4"	32	Fillister Head Screw	Secure Air Cleaner Bracket
2	1/4"			Lockwasher	
1	5/16"	1"	18	Hexagon Cap Screw	
1	5/16"			Lockwasher	
1	5/16"	3/4"	32	Fillister Head Screw	
1	5/16"			Rivet Burr	Secure Stop Switch Block
4	1/4"	1 1/4"		Parker Kalon Screw	Secure Name Plate
2	5/16"	1"	18	Hexagon Cap Screw	Secure Valve Spring Cover
2	5/16"			Lockwasher	
2	5/16"	1 3/8"	24	Fillister Head Screw	Secure Breather Assembly
2	5/16"	5/8"	20	Hexagon Cap Screw	Secure Breaker Plate
2	1/4"			Lockwasher	
2	1/4"			Rivet Burr	
2	1/4"		24	Hexagon Nut	Secure Cylinder Base
4	5/16"			Lockwasher	
4	5/16"	1"	18	Hexagon Cap Screw	Secure Bearing Plate
2	5/16"	3/4"	18	Flat Head Screw	
1	5/16"				

† Available in Depot Stock

TABLE OF NUTS, BOLTS, SCREWS AND WASHERS

Qty.	Size	Length	Thread	Description	Where Used
5	5/16"		24	Hexagon Nut	Secure Cylinder Head
5	5/16"			Lockwasher	Secure Blower Housing
6	5/16"	3/8"	24	Hexagon Nut	
3	1/4"		20	Round Head Screw	
3	1/4"			Shake Proof Lockwasher	
1	1/10	3/8"	24	Fillister Head Screw	Secure Speed Adjusting Lever
1	1/2"		20	Hexagon Nut	Secure Flywheel
4	1/4"	5/8"	18	Fillister Head Screw	Secure Fuel Tank Strap
4	1/4"			Lockwasher	
3	5/16"		24	Hexagon Nut	Secure Starter Pulley and Flywheel
3	5/16"			Lockwasher	
6	5/16"		24	Hexagon Nut	Secure Generator Bracket
6	5/16"			Lockwasher	
2	5/16"		24	Castle Nut	Secure Connecting Rod
2	1/16"	3/4"		Cotter Key	
1	3/16"	5/8"		Round Head Stove Bolt with Nut	Secure Throttle Lever
1	1/8"			Close Pipe Nipple	Sediment Bulb to Fuel Tank
1	1/8"	5/8"		Woodruff Key	Secure Crankshaft Gear
4	1/10	7/16"	32	Round Head Screw	Secure A. C. Brushes and Wires
4	1/10	3/16"	32	Binding Head Screw	Secure D. C. Wires on Brush Holder
8	5/16"	x1"	18	Hexagon Head Cap Screw	Secure Pole Pieces
4	5/16"	x3/4"	18	Hexagon Head Cap Screw	Secure Generator Adapter Plate
4	1/10	7/16"	32	Round Head Screw	Secure Brush Holder Bracket
4	1/10	5/32"	32	Round Head Screw	Secure End Bell Cover
1	5/16"	x5 1/2"	24	Stud	Secure Armature to Engine Shaft
1	5/16"			Hexagon Nut	For Armature Stud
1	5/16"		24	Lockwasher	Secure Armature Stud Nut

† Available in Depot Stock

16. MANUFACTURER'S CODE LIST—

LAU	Lauson Company, New Holstein, Wisconsin.
CSP	Champion Spark Plug, Toledo, Ohio
EM	Eisemann Magneto Co., New York City, New York.
TC	Tillotson Carburetor Co., Toledo, Ohio
EE	Eagle Electric Mfg. Co., New York City, New York.
ME	Marathon Electric Mfg. Co., Wausau, Wisconsin
RR	Roadrite Motor Works, Bluffton, Ohio.
OM	Ohmite Mfg. Co., Chicago, Illinois.
TR	Trumbull Electric Co., Plainville, Connecticut.
CMC	Chemical Metals Corp., Jamestown, New York.
NDBB	New Departure Ball Bearing Co., Bristol, Connecticut.
CE	Cline Electric Mfg. Co., Chicago, Illinois.
ICC	Industrial Condenser Corp., Chicago, Illinois
USC	United Specialty Co., Chicago, Illinois.
NMB	National Motor Bearing Co., Chicago, Illinois.
AHE	Arrowhart Hogeman Electric Co., Hartford, Conn.
MID	Midco Mfg. & Dist. Co., Inc., Sheboygan, Wis.

[A. G. 062.11 (15 MAY, 1943)]

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Chief of Staff.

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(For explanation of symbols see FM 21-6)

4M-12-43